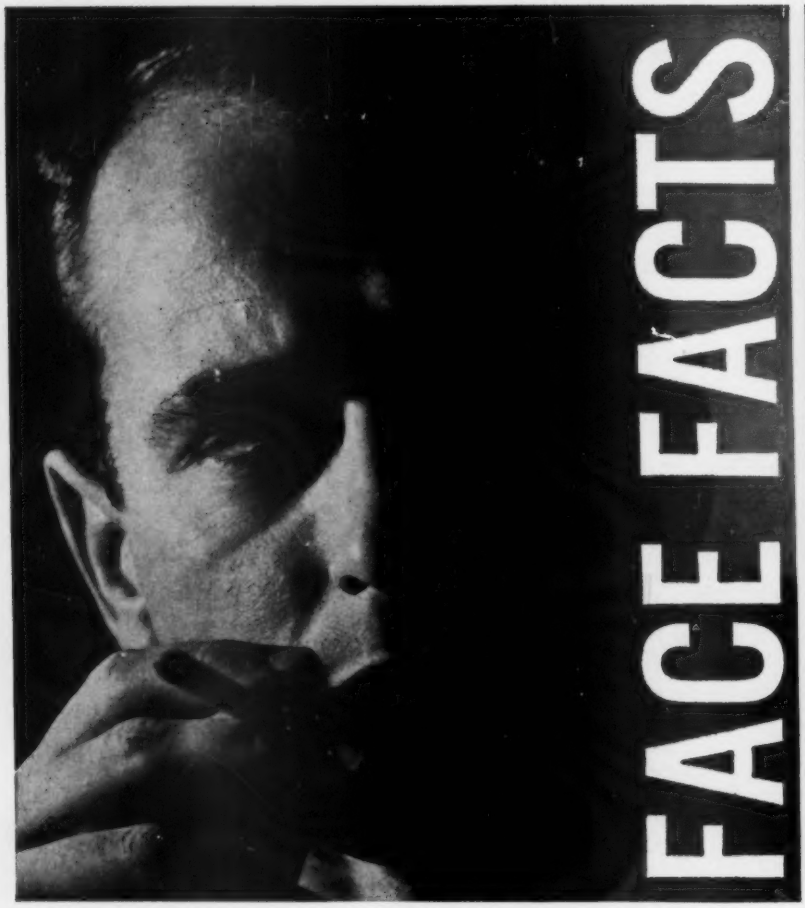
OCTOBER 1961 3/6

AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS

ELECTRONIC COMPUTER EXHIBITION NUMBER

RANDOM FILING VERSUS SERIAL FILING Page 20



Payroll
Personnel statistics
Order processing
Production scheduling
Production planning
Stock control
Purchase accounting
Order invoicing and warehouse stock control
Cost collection
Costing and budgetary control
Invoicing
Sales ledger
Sales statistics
Sales forecasting
Passenger and freight movement statistics
Flight scheduling
Centralised bank book-keeping for branch current accounts
Centralised stock control and accounting for retail branches
Retail prices index

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FIRST all transistor computer to be employed by a major London banking house. (Barclays).

FIRST all transistor computer to work for a customer with high speed magnetic tapes.

FIRST all transistor computer to go into commercial use.

FIRST to handle a payroll task of the size and complexity of BMC's Longbridge employees.

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EMI

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BRITISH DEVELOPED
BRITISH BUILT

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AUTOMATIC DATA PROCESSING

JOURNAL OF MANAGEMENT AND INFORMATION SYSTEMS VOL 3 No 10
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If you are up in the Computer Class

THIS IS AN AD YOU'LL BE GLAD TO HAVE READ

UNLIKE ANY OTHER, the **NCR 315** ELECTRONIC DATA PROCESSING SYSTEM gives you split-second RANDOM ACCESS to all your stored data. Using sixteen CRAM units you could – at any one moment – interrogate in detail a volume of information equal to the capacity of 1,104,000, 80-column punched cards! With its incomparable high-speed input system, the **315** will accept the contents of 2,000, 80-column punched cards a minute (or, using punched tape, 1,000 characters per second). It will add, subtract, compute and analyse at almost the speed of light; and, on its own electronic printer, turn out your Invoices, Statements, Payrolls, Schedules, Summaries, Action Signals, etc. at a rate of over 36,000, 120-character lines per hour.

NCR *electronics*

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ELECTRONIC COMPUTER EXHIBITION OLYMPIA 3-12 OCT **STAND No 14**

BUSINESS EFFICIENCY EXHIBITION OLYMPIA 2-11 OCT **STAND 93/100**

CRAM

the **NCR 315**'s exclusive magnetic Card Random Access Memory

provides split-second RANDOM ACCESS to the entire Main Data File and eliminates obligatory serial processing as imposed by magnetic tape systems.

NCR National

One CRAM will do the work of two, three and sometimes four magnetic tape units!–*and* provide, *at any one moment*, split-second random access to 5,500,000 alpha-numeric digits of information (the equivalent of 69,000 80-column punched cards!). CRAM is integral with, and exclusive to, the **NCR 315** Electronic Data Processing System, and, for that reason alone the comparative capability and operational economics all other E.D.P systems must now surely be re-assessed.

TECHNICAL NOTE: CRAM is cartridge loaded | Each cartridge contains 256 magnetic Mylar 'cards' | Each CRAM 'card' has a storage capacity of 21,700 alpha-numeric characters | Thus, each CRAM cartridge has a storage capacity equal to that of 69,000 80-column punched cards | Up to 16 CRAM units can be controlled by the NCR 315's central processor | For the first time, a random memory device can be utilised for *both* random and sequential processing | For the first time, it is economically practical to employ multiple random access units in one system | For the first time, the contents of a random access memory can be unloaded and reloaded with different data in only 30 seconds! | Thus, any item on any one of 4,096 CRAM cards (capacity, over 88,000,000 alpha-numeric digits) can be selected, read and updated *at random* | Access time to any CRAM card varies between 0 to 200 milli-seconds | Data is read from or written onto CRAM cards at the rate of 100,000 characters per second.

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Largely on account of its very high capacity magnetic core memory of 8,192 'words' (98,300 digits), the all-transistored National-Elliott 803 provides the high-speed computing and analysing capability normally associated with computers twice or thrice its size.

With the addition, as required, of alternative combinations of paper tape and/or punched card ancillaries, output printers and magnetic film information files, the system can be expanded, as required, for highly diversified application. *In quality, compactness and capability, the 803 is a significant achievement in the field of computer engineering. Its low cost represents a triumph for the economics of advanced methods of manufacture.*

National
ELLIOTT

Note: The 803 is made by the Computing Division: Elliott Brothers (London) Ltd.

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The Fully Automated Post-Tronic

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AT OLYMPIA
STAND 15

SEE THE AEI 1010 AT WORK ▬ TALK TO THE PEOPLE BEHIND IT

Programmers, Systems Analysts and Electronic Engineers will be available at Stand 15 at the Electronic Computer Exhibition to show you an AEI 1010 computer and answer your queries.

A complete data processing system will be exhibited, but this is only one of the many which are possible with the AEI 1010 and its wealth of peripheral equipment.

Whatever your problems in the data processing field, there will be someone on the AEI stand to discuss them with you and give you advice.

AEI offers you a complete service—complete from the initial system analysis to the final installation.

AEI will also act as consultants in the design of your computer centre, including supply of air conditioning equipment, heating installations, electrical equipment and lighting.

AEI can also offer attractive rental terms to suit your own application.

For Computer 'Know-how' visit Stand 15, Electronic Computer Exhibition, London. October 3-12.

AEI **Associated Electrical Industries Limited**
Electronic Apparatus Division
Computer Sales Department
TRAFFORD PARK, MANCHESTER 17

A5697

Three Years Later

THE second Electronic Computer Exhibition which opens on the 3rd of this month will be impressive in at least one respect: under one roof will be collected many of the computing complexes, which have long been announced; perhaps shown fleetingly once or twice, these have never been on view for any length of time, even if their photographs and vital specifications are familiar. An exhibition of this kind, where machines almost rub cabinets, is akin to a dog show—' this exhibit,' the viewer may muse, ' costs x thousand pounds and is exactly comparable to something on the adjacent stand '.

Inevitably, this exhibition will invite comparisons with the first Electronic Computer Exhibition held in 1958. It will be found that some companies have made little progress since 1958 in the sense that their ' star ' exhibits at the 1958 show are still their star exhibits three years later; these however, are a minority. Unmistakably, in three years great progress has been made by most computer manufacturers: the machines offered in 1961 are faster, more powerful, more reliable than previous machines—more important still, manufacturers have ' tailored ' their computing systems much more to the requirements of the data processing user. What may be found more remarkable than the so-called ' new generation ' of computers, however, are developments which offer the smaller firm the means to introduce automation in the office without going all the way to a computer. Many of these developments will be shown for the first time: they should not be lightly dismissed.

An exhibition is always a good time to take stock of progress, and in this issue we devoted several pages to doing just that. A preview of the exhibition is prefaced with articles which gauge the progress of the technique of automatic data processing, examine the contributions of individual manufacturers, and take the industry's pulse.

* * *

Four experts have contributed to a debate on the relative merits of random access filing and serial access filing, which we publish this month on page 20. Clearly, the battle of ' random versus serial ' will remain unresolved until with their orders computer users make it apparent which method of filing they prefer, but putting the opposing views of our contributors in juxtaposition provides considerable insight into different approaches of using computers. It is probably impossible to say that one approach is better than another, for circumstances can nearly always be found to alter the best approaches.

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in their practical applications than any other organization in the world

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DATA DIGEST

Atlas Computer Ordered

Harwell's National Institute for Research in Nuclear Science is to instal a Ferranti Atlas computer. Apart from the Atlas machine built for Manchester University, this is the first order received for this giant system. The National Institute's machine (whose vital specifications will be 48,000 words of core store—plus 8,000 words of fixed store and a further 1,000 of working store—four magnetic drums and 16 magnetic tape decks and a capacity for performing a million simple additions in a second) will be established at the Rutherford High Energy Laboratory, Harwell, and will be available for use by universities as well as the UKAEA and government departments.

The cost of installing this system will be about £3½ million; this figure includes the cost of new buildings to house the system.

The economics of developing very large machines must be somewhat chancey, as the decision recently taken by the IBM Corporation to accept no more orders for their Stretch computer and to discontinue making it after current orders have been met clearly shows. Stretch, the most powerful machine yet devised, was developed to US Government specifications, and although a Stretch machine is already working at the Los Alamos research centre of the United States Atomic Energy Commission, it was found that it cost far more to develop than could be charged for it. With the Ferranti Atlas, according to an independent estimate, with this first order Ferranti will just about break even on development costs.

Apparently undeterred by IBM's experience with very large computers is another American company—General Precision—whose Librascope Division recently announced a very powerful computing system, designated L-3060. Described as a multi-computer system (capable of performing nearly 2½ million operations per second, and with capacity for 144,000 words in core store and a further 3¼ million words in magnetic disc files) the L-3060 appears to be four computers linked together and communicating via a common memory. What is surprising is that deliveries of the system are ' on a 10-month basis '.

Documents Retrieved

IBM's electronic document file

An electronic system capable of retrieving in five seconds any one of millions of printed documents or photographs from a file centre has been developed by IBM. The prototype, dubbed Walnut, was developed for the US Central Intelligence Agency, but it is probably only a matter of time before IBM offer a version of the system on the market.

Key to the system is that a microfilm image of the actual document is framed in an IBM card (which can then be screened or used to get a printed version), and thus the original document does not have to be removed from storage.

The Walnut system operates like a library: a catalogue of the items held is kept in a magnetic file, and the ' shelves ' comprise over 100 bins, each loaded with 920,000 documents (in fact these are reduced or microfilmed copies of documents).

When a user requires information he writes key words on a form, from which punched tape is made and fed into the machine. The magnetic index is searched electronically, and a list of entries containing the key words is printed.

Punched cards, corresponding to the documents that the user then selects, are pulled from a file of cards prepared when the document was printed, and con-

taining the location of the document. This information is punched into an aperture card containing a blank film insert.

The unexposed aperture cards are inserted into the document file which reads the location and brings the relevant part of the film strip into lens position, and this card's film insert is exposed and developed within about half a second. The document can then be read through a viewer or enlarged for printing.

Money for research

IBM found fellowships

IBM United Kingdom Ltd have announced they are founding three research fellowships, one in each of the years 1961, 1962 and 1963 which will be tenable at any university or university college in Britain. No restriction will be made as to the field of study, and the value of each fellowship will be at the rate of £1,150 a year for three years.

New order

is replacement order

AB Datacentralen of Sweden, the data processing subsidiary set up by the two Swedish insurance companies, Trygg and Fylgia, which does data processing work for the principals on a Ferranti Perseus machine, have ordered an Orion system. The Orion equipment will replace the Perseus computer in two years time. At present the Perseus, a valve computer, is used to process 1½ million insurance policies held on magnetic tape.

Collegiate Machine

Another college acquires computer

Recently installed in Cardiff at the University College of South Wales and Monmouthshire was a Stantec computing system; it will mainly be used by the College's crystallographic research team, led by Dr D Rogers. Later other departments of the University College will be able to use the machine, and it is planned to make some computer time available to outside organisations.

The Welsh College of Advanced Technology in Cardiff has had a Stantec Zebra computer for some time.

Courses for Teachers

ICT Indoctrinate?

Like other computer manufacturers ICT have found that training is an essential prerequisite to selling, and last year 6,500 people passed through ICT training establishments. Recently ICT ran two residential training courses for teachers and lecturers of training colleges. One was a one-week computer appreciation course held at ICT's country seat, Bradenham Manor, and the other devoted to electro-mechanical punched card applications and techniques was held at ICT's Cookham training establishment. A total of 20 people—nine on the first course and 11 on the second —were tutored. A small beginning—but ICT intend to repeat the courses in 1962.

Council's order

Switch from card equipment

Due to graduate from punched card equipment to a computer is the Lewisham Borough Council, who have ordered an IBM 1401 system. One of the 23 London borough councils who collectively run a large O and M department, Lewisham decided to acquire its own computer rather than use the machine being acquired by a syndicate of six councils (the South East London Computer group which comprises the councils of Greenwich, Bermondsey, Woolwich, Southwark, Camberwell and Deptford) or a modern 40-column punched card installation. Lewisham are due to take delivery of their 1401 in 18 months —that is in January 1963; the machine will cost over £64,000.

SCB Order

Integrated accounting the aim

The computer which is to be housed in the Scottish Coal Board's £200,000 Edinburgh centre, is to be the AEI 1010. The order is the first made by a Division Coal Board, and only the second outside order received for the AEI 1010—the first was for the RAF stock control centre at Hendon.

The Computer's role is seen as first, handling the Coal Board's 96,000 payroll; secondly, the costing and accounting of the board's material and supplies — some 14,000 items; and finally the recording of despatch of daily coal deliveries—no small matter, since there are some 1,200 different grades of coal and deliveries average 4,500 loads per day. The AEI 1010, which is to cost £250,000, should be installed by the latter half of next year; the first move, say NCB, to rationalisation of machine accounting throughout the whole industry.

Narrative Retained

Bank computerises, with reservations

One of the oldest established banks in London, Messrs Coutts and Co, are to have a Univac. Announcing this, the bank said they had stipulated that a full description of transactions, as under the non-computerised system, were to be printed out on customers' statements. This is in contrast to the other Big Five banks who have computerised, where the narrative has been reduced to just a cheque number and a series of explanatory symbols.

The computer, a solid state Univac 80 STEP tape model, will be delivered next spring. The complex comprises a central processor —with 28,600 digits of storage; two tape units; reader/punch and high speed card reader; and a high speed printer which will produce statements and daily balance lists on-line at a rate of 600 lines per

INSTALLATION ROUND-UP

1 At the London headquarters of J Sainsbury Ltd, the grocery and provision company who are currently expanding in the supermarket field, is this Emidec 1100 computing system. The first provision chain to adopt a computer, Sainsbury use their machine to provide central control over all stocks, ensuring that stocks are kept to minimum levels and turnover quickly.

The machine will also be used to keep tabs on the buying habits in different types of districts and seasonal fluctuations in demand in certain lines. A study of past trends is vital for predicting future sales, accurately, and when this can be done adequate stocks can be ordered in good time.

2 Delivered last May, this Pegasus II system has been working at the Liverpool head offices of Martin's Bank Ltd on the current accounts of a number of branches. Martin's approach to using a computer for current accounts—they had experimented on Ferranti's service centre Pegasus before ordering their own machine—is for the individual branches to prepare information for current account statements in punched tape form. Adding machines which produce paper tape as a by-product have been introduced into the relevant branches and the bank are now issuing 'personalised' cheque books (*ie.* cheque books with the customer's own account number) to make the business of preparing tapes easier.

Martin's plan to have a second computer to serve branches in the London area, and are currently making studies of various machines.

minute. Source data will be prepared on AKPs which will both print and punch information on 80 column cards.

The first jobs to be put on the Univac will be customers' current, deposit, and loan accounts ledger accounting; later registrars' and securities' accounting, travellers' cheques, and statistical returns of several kinds are to be added.

Payne to penetrate

Automation analysis research

Dr L C Payne of Elliott Brothers (London) Ltd is to head a new department to investigate the true mathematical nature of industrial processes. This is being undertaken, say Elliotts, because they find that lack of adequate knowledge in this field is holding up the introduction of complex automation processes.

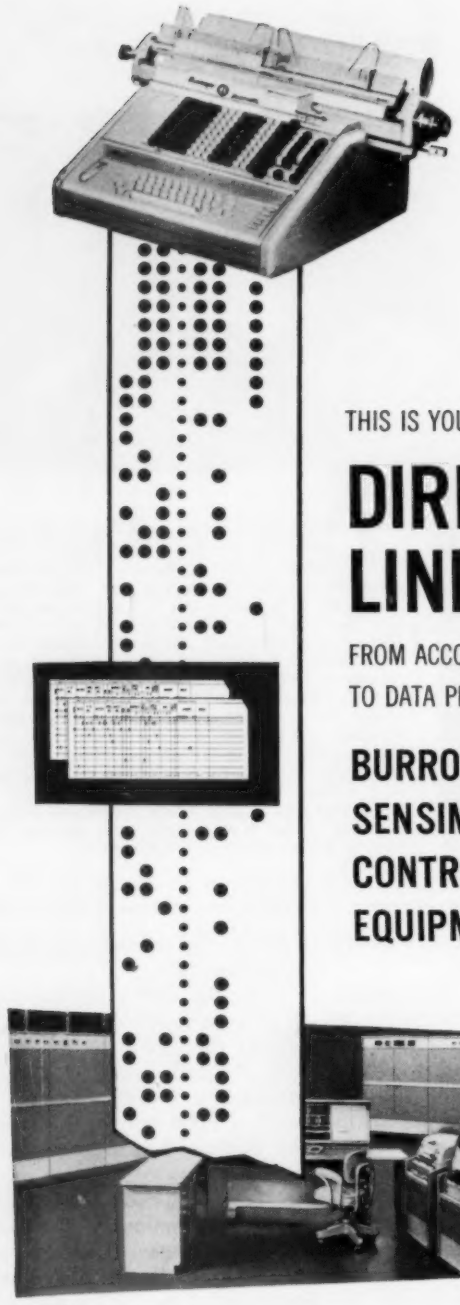
Dr Payne's new department, that of automation analysis, will do field work on the experience accumulated by Elliotts of the on-line and off-line application of computers and control devices to industrial processes in this country and the USA.

Translation by computer

American boffins demonstrate

The first demonstration in Britain of machine translations from Russian to English, and from Russian to German, was given by Machine Translation Inc, an American research company, under the auspices of CEIR (UK) Ltd on 5 September, to coincide with the First International Congress of Mechanical Translation held at the NPL.

Using the 7090 computer (and all 12 tape units) at IBM's Data Centre, the prototype UTS system (Unified Transfer System) translated a Pravda article at a speed of 1,000 words per minute. The Russian dictionary required for this translation, held on magnetic tape, comprised 5,000 words; the English dictionary of linked word meanings amounted to 32,000 words. When the production model of the UTS is finalised next year, the dictionary will be expanded to 50,000 Russian words and 300,000 English meanings, and the speed of translation raised to 150,000 words per hour. If the CEIR's Stretch Computer is used it will be possible to translate at a million words per hour.



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Produces records as it punches card or tape

Burroughs Sensimatic Control-Input Equipment permits the input problem to be tackled at its source, i.e. the department or branch where the original media is first processed. Here, punching of Numerical or Alpha Numerical data may be undertaken with equal facility by the Burroughs Sensimatic Accounting Machine in one operation.

The machine is so simple that anyone can use it without special training.

The moving, electrically-operated carriage permits the production of one or more records at the same time as card or tape punching is taking place. An automatic line proof of accuracy of the accounting information punched is obtained, and up to eighteen twelve-digit control totals are accumulated and printed.

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The fastest Leo yet in harness soon!

LEO III, the latest and fastest LEO Automatic Office, will start service trials soon, in preparation for the opening of the fourth LEO Service Bureau in London early in 1962. LEO III, incorporating every significant advance in commercial data processing, will make available the LEO service to a still wider circle of businesses—both large and small.

Six basic facts about Leo III

1. Magnetic Core Store of up to 160,000 digits, automatically shared amongst several concurrent jobs.

2. Special buffering arrangements between computer and input/output equipment to enable all to work continuously.

3. Comprehensive and extendable order code, with ability to calculate automatically in binary (fixed or floating point), decimal or sterling numbers, according to the particular calculations.

4. Fast printing—up to 60,000 lines per hour. Fast magnetic tapes with unsurpassed built-in error detection.

5. Fully transistorised circuits, with checks at all transfers, high reliability and the fullest attention to ease of operation and maintenance.

6. Made up of independent units which can be added to on site as needs increase, without interrupting routine operation.

MORE FACTS? Complete information on LEO III and the LEO III Service Bureau is available from LEO Computers Ltd. If you are interested contact them now. Telephone Bayswater 9451.

Seven jobs Leo III will be doing

1. Invoicing, sales forecasting, sales analysis.

2. Stock and warehouse control.

3. Production scheduling and control.

4. Payroll and wages costing.

5. Engineering and Market Research.

6. Stock Exchange and Insurance Accounting.

7. Share register work.

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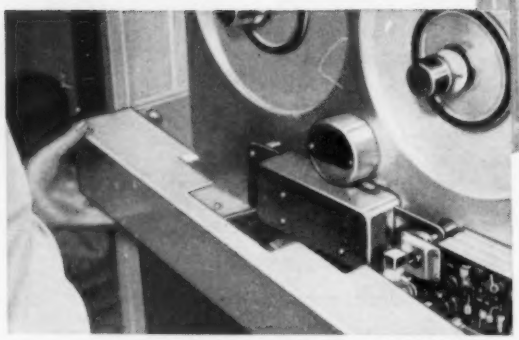
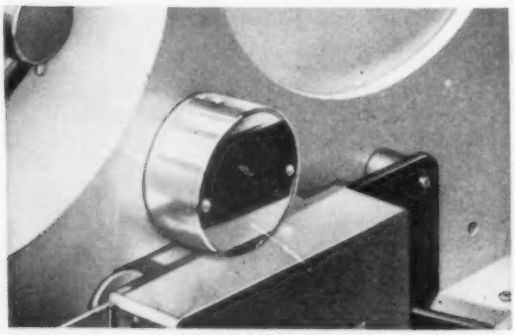


Vacuum capstans *not* pinch rollers to safeguard tape



. Recording head alone touches tape surface

AIR CUSHIONED TAPES

Only Honeywell 800 and 400 high speed systems transport magnetic tape *by air*.
Vacuum capstans replace old fashioned pinch rollers, dramatically reduce wear and tear, flaking and scratching.
Nearly every read-write error can ordinarily be traced to tape surface damage—a fact that adds force to Honeywell's guarantee that they will replace any tapes damaged by their systems.

AND ORTHOTRONIC CONTROL

With this other exclusive Honeywell feature, uninterrupted accuracy is assured throughout processing. Lost or damaged data are recreated instantaneously without human aid, without reprocessing. Errors can be detected and corrected in 1/20th of a second.

These are just two of the reasons why Honeywell EDP systems are acknowledged leaders of 'the new generation'. For details of the others—the true parallel processing, the simplified programming language, the speed and accuracy—write to Electronic Data Processing Division, Honeywell Controls Limited, Greenford, Middlesex. Waxlow 2333.

Honeywell

Electronic Data Processing

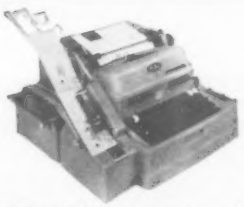
introducing a new generation in cybernetics

Friden

(PRONOUNCED FREE-DEN)

Firstly, introducing Friden Limited (the *Limited* is new), a British Company formed to provide a specialist service and equipment in the field of calculating, Integrated Data Processing and allied subjects: secondly, introducing the latest range of equipment bearing an international name already familiar to British businessmen (although we would like to put the correct pronunciation on record!)

Some of the machines are shown here; a few must be new to you; most show Friden's mastery over 'tape automation'; all provide a new freedom from overproduction of paperwork and wasteful excess of documentation.

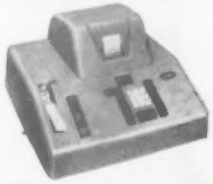


FLEXOWRITER auotmatic writing machine producing punched tape as a by-product of typing: the basis of IDP.

SRW CALCULATOR, the only desk calculator in the world which automatically extracts square roots at the touch of a key.

COLLECTADATA maintains control in decentralisation; collects data from any number of points and punches it into paper tape at processing centre.

JUSTOWRITER, tape-operated type composing machines, provide justified copy in a wide choice of type faces, on paper or plates.



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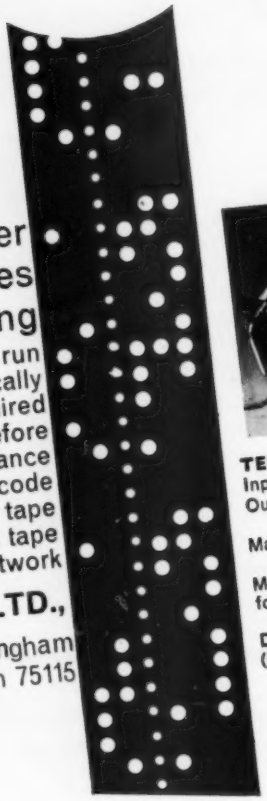

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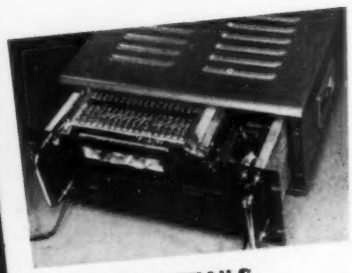

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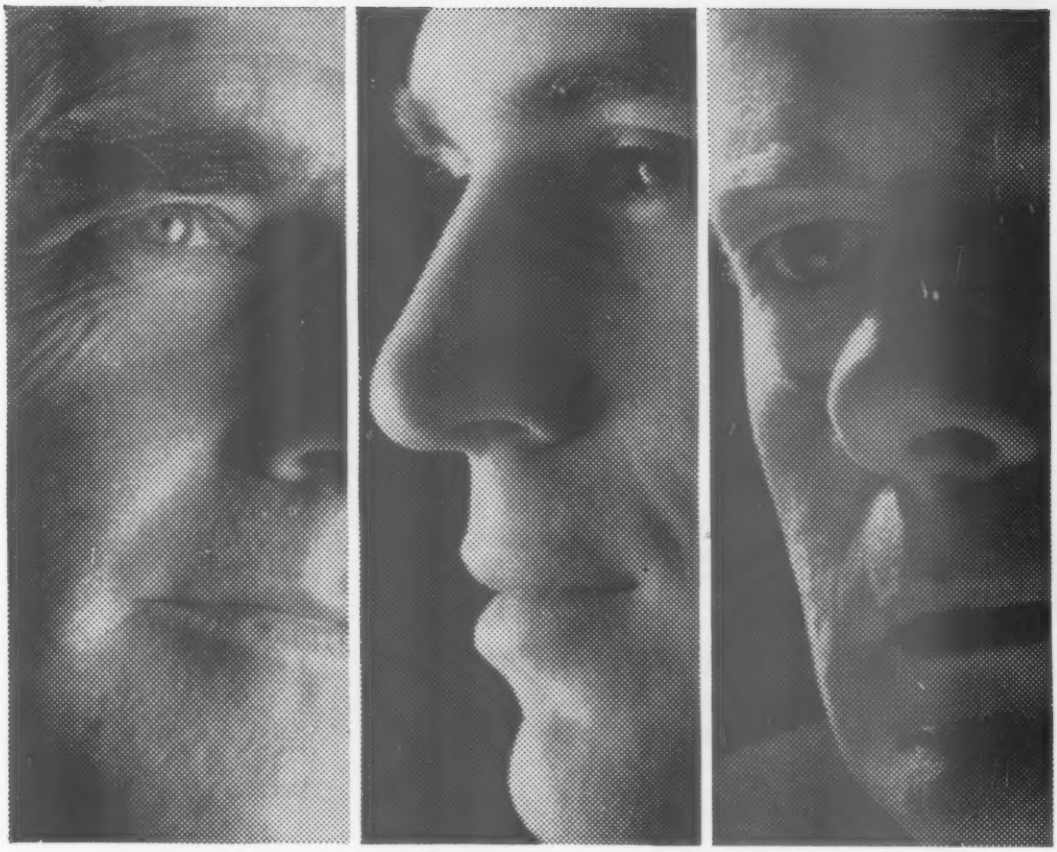

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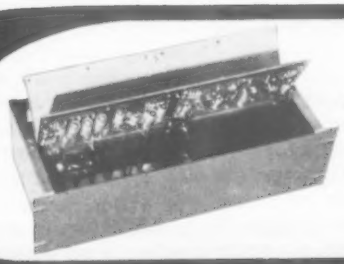

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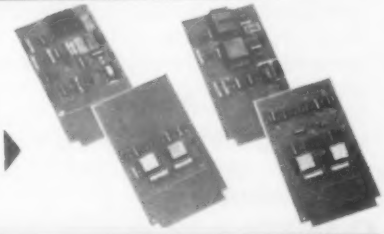

Various A.T.E. systems, as adopted by a number of British computer manufacturers and as chosen for use in the fields of research, defence, distribution and finance, are in operation at the Computer Exhibition at **STAND 19 OLYMPIA 3-12 OCTOBER 1961**

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Random Access

VERSUS

Serial Access

Two methods for storing information—which is preferable?

Until recently the best way of storing large volumes of information outside a computer so that it was easily retrievable was to use magnetic tape. Now random access devices of various types are being offered to do the same job. Which of the two methods is preferable? To find the answer to this question AUTOMATIC DATA PROCESSING *approached four computer experts and asked them to argue the case.*

THE CASE FOR RANDOM ACCESS I

JACK CROWNSHAW

RANDOM access memories have—unfortunately—one obvious advantage, implicit in the name. I say 'unfortunately' because in over-emphasising the obvious, people easily miss the real significance of this tremendous advance in automatic data processing techniques.

It is certainly true that if a computer user has to deal very quickly with a large number of *ad hoc* enquiries, random access is the only practical answer. But this does not mean that those are the only circumstances in which random access enables work to be done more efficiently than with the conventional types of sequential memory.

It is also misleading to argue the case for random or serial processing, as though it were a free choice which could be made, all else failing, by spinning a coin. What suits one clerical operation may not suit another.

Take, for example, the issuing of bills by a public utility. This is usually done on a pre-determined cycle. Therefore it is most convenient to do it in serial order. But some customers pay more promptly than others, so the incoming payments do not match the original sequence of accounts. Unless the public utility has some means of *selective* posting, the work must start with a massive pre-sorting operation, which either costs a great deal in clerical labour or takes up an inconveniently large proportion of the available computing time. Moreover, the utility will certainly receive a number of *ad hoc* enquiries which cannot be dealt with quickly on a serial basis.

JACK CROWNSHAW

is head of National Cash's computer commercial sales team. An O & M man with the old LMS from 1931 until the war, he joined National Cash as salesman in 1947.

The point is simply this: a serial memory can only handle work which has been sorted into serial order, whereas a random access memory can handle all kinds of work in whatever order best suits the operation.

This, I think, is unarguable. Therefore the prospective user is primarily concerned with three questions: (1) Does the use of a random access memory slow down the processing in cases where it is more logical to provide input data in sequential order? (2) Can it provide the same total filing capacity as magnetic tape at a comparable cost? (3) What additional advantages has it over magnetic tape?

In answering those questions I will be thinking —naturally enough—of the Cram random access memory developed by my own company, because Cram is the outcome of a determined effort to couple the speed and other advantages of electronic processing to the extreme flexibility associated with manual filing systems. But many of my arguments will apply in principle to other kinds of random access equipment.

First, the question of speed. Many people are misled by vague references to ' milliseconds per operation '. But the plain fact is that on any type of processing—sequential or random—a properly designed random access system is invariably faster than magnetic tape in Britain.

Why? Consider an account posting operation in which the file contains 150,000 records and the average rate of posting per run is 1 in 25 records (a fairly typical level of account activity). With a serial memory the computer would have to look at every one of those 150,000 records; but with a random access memory it would have to look at only 6,000 of them, skipping ' randomly ' down the sequential file.

That, however, is not the whole story. Let us assume that the work is being done under the conditions most favourable to sequential processing—that is, where every record in the file has to be updated during a single posting run. Here, too, we find that our properly-designed random access system is faster than any of the magnetic tape systems at present available in Britain.

Another important aspect of random access filing is that one relatively small backing store can contain a number of different (but related) records. For example, in one Cram file it is possible to provide magnetic cards for (1) sales ledger (2) stock records (3) pricing (4) orders pending (5) overflow data (6) input data.

In a conventional memory the records for items (1) to (4) would be stored on different reels of tape, each of which would require its own tape-handling mechanism. On this basis it is fair to suggest that one random access unit can often replace four tape units.

Tape has the basic advantage that the reels are quickly changed. But recent developments have extended the same facilities to random access storage. Therefore, in both cases the total filing capacity of the system is virtually unlimited. Cram uses magnetic cards housed in easily loaded cartridges. This means that where the number of memory units is limited by economic factors, it is quite feasible to split the records into a number of ledgers, each represented by one Cram cartridge. Admittedly it will then be necessary to sort the input data into ledgers; but the total file would have to be very large indeed before this sorting operation needed more than one simple ' pass '. Moreover, the use of separate ledgers is wholly in line with the accepted principles of bookkeeping.

With magnetic tape there is a tendency to make virtues out of necessities. One example is the use of ' father and son ' techniques, in which the whole contents of the file are read and re-written on to new tapes whenever processing is done—even though only a small percentage of the records have been updated. With random access it is only necessary to handle those records which need updating. Therefore the troubles caused by wear and tear are likely to be much reduced. On the other hand, conventional ' father and son ' techniques can be employed with random access storage, if desired, provided that the system incorporates at least two file units.

A major (but not always recognised) advantage of random access is that it provides greater programming flexibility. The ' ideal ' business computer would have an immediate access ferrite core store large enough to hold all the routines and subroutines which were liable to be called upon during the processing of any type of work. Unhappily, the high cost of core storage generally puts this ideal out of reach. Only the most commonly used parts of the computer program can be held in the working store; the rest must be stored elsewhere.

If a conventional memory is used for this purpose, it raises an old problem—the inconvenience

of running through yard after yard of magnetic tape to find new program instructions which are suddenly needed. With random access this difficulty disappears. The least used routines can be held in the file and transferred to the working store immediately they are demanded. Thus the machine has the ability to switch from one job to another without delay.

This is an important facility. However hard the user tries to organise his work for long, uninterrupted processing runs, it often happens that the machine has to break off because required data is not available or because it has suddenly become necessary to process data in some way not prescribed by the main program routines.

The ability to *process at random* is an enormous aid to efficient programming. It enables programmers to explore a number of different ways of doing this job, whereas with conventional systems there is often no choice in this respect.

Finally, there is the obvious advantage which I mentioned in the first paragraph. If the user's work involves a lot of *ad hoc* enquiries, magnetic tape is useless. Only random access can do the job.

THE CASE FOR SERIAL PROCESSING I

FRANK LAND

IT is an oversimplification to present the choice of storage in a computer system as a simple dichotomy between random access and serial access. Every data processing system has some components of each type. Even the typically serially processed payroll, uses a random access technique to extract National Insurance contribution, tax rates, cost allocation, etc, from tables held in the computer memory. And even the typical random access job of airline reservations uses a sequentially sorted program. Between these extreme cases there is a complete range of jobs with greater or lesser requirements for the two types of storage. In practice, however, a choice has to be made between having the bulk of the storage available serially or in random order. In most cases the advantages and disadvantages of the two systems must be balanced against their costs.

I should like to bring out some of the relative advantages of serial storage that might be overlooked when it is compared with a system which is, superficially, so similar in principle to present manual storage methods.

In the first place, the change to ADP is not made simply to post transactions to ledgers. The change is usually made worth while precisely by the computers' additional ability to scan all the entries in a file and to draw attention to those entries which require management actions, such as customers whose accounts are overdue, or stock that has not moved or deliveries which are not on schedule. *The simple posting of* 6,000 *transactions to* 150,000 *accounts is a job for accounting machines, not for a computer;* a computer is really only fulfilling its function as a management tool when it is examining all the items in a file to determine which of them require managerial action.

In very many computer jobs the data may arrive in random order. But nearly always the output—the orders on suppliers or workshops, the payroll or delivery notes or statistics—is required in batches in a particular order. Delivery notes may be required in customer order, and within customer order in item number order, or perhaps stock location order. Again the natural method of dealing with this is to batch the data, and to use the computer to organise them into the sequence required.

Most records read in computer jobs hold a variety of information, and it is often difficult to assess the typical size of the record. A customer record may, for example, hold the customer's name and address, and for some customers a second consignee's name and address. In addition it would hold details of all transactions recorded since the last statement was printed. For some customers there may be no transactions, for others hundreds. In a serial type of memory like magnetic tape, the space occupied corresponds to the number of details recorded, as it does in a manual file. In a random access system the planner is faced with a problem. If he attempts to use his available storage space efficiently by keeping the area allocated to each customer down to the average number of characters per record, he may require overflow areas and multiple accesses before he can extract the required information. If he attempts to minimise the number of times he calls for access he is bound to waste storage space. In any case, changes in volumes will upset any calculations he has made. Again the tape system is straightforward and flexible.

Experience has shown that computer users are faced, from the moment they have started to plan computer jobs and throughout the life of a computer, with many changes of requirements, and many changes in data volumes and record sizes. A basically magnetic tape serial processing type of computer system is sufficiently flexible to deal with most changes of requirements or changes in volume. Its serial store (magnetic tape) is unlimited. Changes in requirements can be dealt with by changes in tape layouts, or additional tape records, or sorting outputs into different sequences. This same flexibility is not present in systems which depend on holding records inside limited random access stores.

FRANK LAND

is deputy marketing manager of Leo Computers Ltd. A research graduate in economics at the LSE, he joined the statistical section of J Lyons & Co in 1952 - transferring to the newly formed Leo Computers as a programmer in 1957.

One of the greatest benefits of using the serial processing approach particularly with a computer having a reasonably sized, and priced core store of 8,000 to 16,000 words, is the possibility of holding a complete program in the rapid access store, and thus avoiding the bane of all programmers, the program divided between different levels of storage. The disadvantage in holding programs in the rapid access store, and the less frequently used routines in a backing store, is again the lack of flexibility. Efficiency in such a process depends on the program planner knowing precisely the frequency of occurrences both now and in the future, and in being able to cater on present knowledge for the changes in requirements which will occur in the future.

The facility of time sharing, which is the modern development in computing systems, can be used to deal with the problems of *ad hoc* enquiries. An interrogation program is always available to the computer, together with the record to be interrogated. As soon as an enquiry arrives the interrogation program automatically interrupts the main program, deals with the enquiries and, finding the correct place in the record, prints the reply. In this way the useful operation of the computer proceeds concurrently with the answering of the enquiries. In practice it has been found that the ability of the computer continuously to monitor records, and to report where action needs to be taken, has reduced the requirement for *ad hoc* interrogations to a significant extent.

Finally, the virtues of the ' father and son ' techniques cannot be overstressed. The importance in data processing, of being able to go back to a brought forward record in order to repeat a process which has been carried out erroneously, must be obvious. Errors in processing can arise from bad data, from faulty operating, and from machine failures. Even the most stringent checks cannot avoid errors occurring. In the case of random access processing, the brought forward record is immediately overwritten by new information. It is like a manual accounting system in which all new entries in a ledger are made by rubbing out the previous entry and writing in new ones. To provide ' father and son ' techniques with a random access system, one is either obliged to use two file units or, alternatively, to add magnetic tape equipment so that the contents of the random access unit can be ' dumped ' at periodic intervals.

Any computer system must, to a very great extent, be rated in relation to its ability to cope with changes smoothly and effectively. And if there is one thing that cannot be afforded, it is a possibility, however remote, of losing major records. Measured against these criteria, the overall serial approach will frequently appear to have the advantage.

THE CASE FOR RANDOM ACCESS 2

JAMES MARTIN

THE traditional Dickensian clerk, with his bound ledgers, handled accounts in an efficacious way. He was ready to post fresh transactions as they arose, in any sequence, to all the appropriate accounts. He performed all the necessary operations in a logical sequence before starting the next transaction. His method was simple, direct and—providing the flow of work did not become too great—immediate.

With the growth of the machine age, however, the volumes of work mushroomed. The clerk had to be replaced by much faster methods. ' Batch processing ' became essential. An array of single-purpose machines or departments were used and information passed through them in turn. A small part of the work only was done at each stage. Delay was inevitable in accumulating a batch, and the more complex the job, the more times the records had to be batched. The greater overall speed compensated for the ever-growing loss in immediacy.

Random-access files attached to an electronic computer are the modern equivalent to the bound ledgers and low wages of the Dickensian clerk. They enable firms to return to his simple and immediate methods—' in-line ' data processing.

There should be only one reason why a firm chooses random-access rather than serial-access on a computer; this is because it makes the *overall* profitability of the system greater. I outline below five ways in which the use of a random-access file has been found to make installations more economic.

First, the cost of the machine itself may be less. The price of a random-access file is often less than that of an equivalent number of tape units. There will always be many different ways of doing any data-processing job and when analysing a system, these should all be timed and costed in detail for different machine configurations. It amazes me how frequently this is not done by firms ordering computers. There is more than one firm in England today with a magnetic tape computer on order to do a job that could be done on a random-access machine not only more efficiently but also more cheaply.

Secondly, a random-access machine may be faster. Finding an item in a computer file can be compared to locating a piece of music in a Hi-Fi unit. With a gramophone record the needle can be moved directly to the band in question. This is random-access. With a recorded tape, the tape has to be wound on until the position of the music is reached. This is serial-access and takes much longer.

JAMES MARTIN

runs IBM's 1401 Test Centre in Newman Street, W1. Graduated in Physics at Oxford, did two years on rocket motor research then entered IBM as programmer, specialising in random access machines.

This disadvantage of tape can be overcome in most cases, but not all, by batching the work and repeatedly sorting. However, sorting occupies the processor for long periods and in many large computer installations 60 percent of the time, or more, is taken up by sorting operations. To keep some of the items in a random-access file can cut out some or all of the sorts.

With the IBM 1301 random-access files which can be attached to various large computers any length of item from among 250 million alphanumeric characters can be obtained in 180 milliseconds and many of the 'seeks' take only 50 milliseconds. Furthermore this 'seek' time is completely overlapped with processing, and separate arms may be seeking simultaneously.

Thirdly, all types of enquiries can be handled without delay, if necessary by a typewriter miles away from the computer.

Fourthly, there may be a saving in staff. Programs and controls may be stored on the file. The elaborate tape handling procedures—collating and controlling—that are essentially part of batch processing may be cut out. Additional paperwork is minimised. In a bank, for example, to answer counter enquiries it would be necessary for a tape-oriented computer to print ledgers or details of postings and this would involve manual control.

Finally, and this may be the most significant advantage of random-access, it may make it possible to tackle much more complex data-processing jobs. Serial processing is easily used to do simple individual applications like payroll and billing. With the move to more integrated data processing, the sequential technique becomes more overburdened. In the more advanced production control applications, such as scheduling and perpetually re-scheduling governed by feed-back from the shop floor, it is virtually impossible to use solely serial access. In an application such as this the computer is required to make a large number of logical decisions based on data from machine tool queue records, operations records, etc, extracted quickly in an unpredictable sequence—extracted *at random*. It is required to change parts of its program, pulling new sections of program down from the files as required.

This is a complexity and flexibility that again compares with the Dickensian clerk. It is the ability to use facts and figures at random as required. The clerk would have been excellent for production control if he were a thousand times faster and unfailing in accuracy.

Finally I think it very important to stress that it is insufficient to consider random-access by itself for any application. It is equally insufficient to consider serial-access by itself. To do a computer study properly both must be considered, and frequently the best solution is to have both types of units on the same machine. Only detailed timing and costing of the various approaches will answer this.

THE CASE FOR SERIAL PROCESSING 2

GEOFFREY ZIMAN

A COMMON feature of all the arguments so far, is the fact that the choice between random access and serial information storage is not a

Continued on page 56

Last June into this new £400,000 headquarters in Bracknell, Berks, moved Dorothy Perkins Ltd. The company have build an up-to-date warehouse of some 45,000 square feet to house merchandise and to serve the company's 170 dress shops. At the same time as this building was being planned Dorothy Perkins' executives studied new methods for doing the paperwork. Result: a computer system for controlling stocks and preparing branch invoices that dovetails with the warehouse and delivery procedures

New Systems for a New HQ

Moving headquarters gave this company the opportunity to centralise and automate

Keith Bean

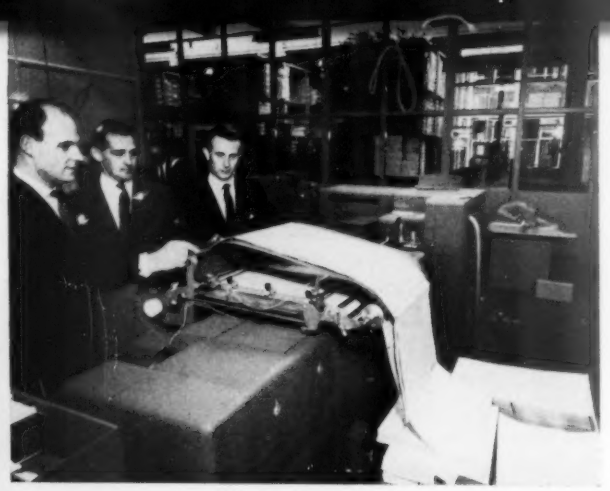
A COMPLEX computer system can be selected and put into operation well within a year—that is what Dorothy Perkins Ltd have just demonstrated. They have also shown that untrained shop girls—untrained clerically that is—can create, at the point of sale, the machine language cards which form the input for such a system.

Dorothy Perkins' computer, a De La Rue Bull Gamma 3 system, is being used to control and allocate stock, as the name they have dubbed their system indicates —'Sadie' (standing for 'stock control and distributing invoicing equipment').

The computer system was conceived at the same time as Dorothy Perkins began building new headquarters and a big new warehouse at Bracknell, in the Berkshire countryside.

'This is a complete system affecting the whole function of distribution from central warehouse to branches and coupling in with the conveyor system and indeed the entire layout of our new warehouse,' the company's execu-

Each branch receives availability lists of all warehouse lines. They mark on cards the stocks they hold and send the cards to headquarters, where the information is transferred into the computer drum store . . .



. . . The computer works out the branch allocations, produces invoices, adjusts stock balances, producing a full daily warehouse stock list and dispatch list.

tives explain. ' Everybody has been in on its creation.'

Dorothy Perkins are a chain of 170 women's shops which sell stockings, corsetry, underwear, dressing gowns, knitwear, swim suits, cotton dresses and separates. The company has increased its branches by 38 in the last 34 months—19 in its last financial year—and it plans to continue that sort of expansion.

Differentiated by garment definition, size, colour and price, there are some 3,500 lines. Seasonal peaks in selling—at Easter, Whitsun, July–August and Christmas—are prepared for by building up stocks at the branches (the shops) in advance and their sharpest impact is felt in the trading rather than in the administration.

The shops are classified into six basic grades, according to size of turnover, but the aim of all of them of course is a quick stock turnover. Each shop has its registered stock—its theoretical optimum stock—expressed quantitatively for each garment definition, size and colour.

The branch registered stocks can be adjusted by a central decision which can be implemented immediately. By this extremely flexible system the branches can, for instance, be held back automatically from stocking up with one line when a new line of similar type is due to come into distribution, say, in the following week.

It is the company's established policy and it was a key thought throughout the consideration of any possible new system that all stock should be distributed evenly through all branches. In other words, one branch order may be opened before another but that does not mean that the first order will be filled at the expense of the second. If there is any shortage of supply of a particular line, the available stock is so allocated as to give every shop a fair share.

The job at Bracknell, as David Roxburgh, a director and the company secretary, put it, is breaking the bulk supplies from manufacturers and distributing them to the Dorothy Perkins branches. Since the branches are shops, and not big stores, and the average unit of sale is comparatively small, the central warehouse has—in actual units of merchandise—an enormous bulk to handle.

This naturally loomed large in considering any new system.

The old method was that each branch used to list its stock on peg lists every week and work out its own orders. The lists were put together at the warehouse and the demand of the branches was dealt with manually by the line codes—that is, line by line and not branch by branch. Warehouse operatives then sorted out all the problems which could arise (from shortage of stock in any particular line, for example, or again, a request from a branch that it should not be sent a particular garment).

With the growth of the business and the contemplated move from central London to the much bigger premises at Bracknell, the need for an improved system was given close study and a number of ways of streamlining the business emerged.

For instance, it was decided early on that orders should be dealt with on a branch-by-branch basis instead of line by line, and another change was the decision that all merchandise should be ' pre-invoiced ' to the branches.

Again, whereas on the peg lists the branches had been listing everything even if the warehouse could not supply it, it was decided that clerical work could be cut if they ordered only against available stocks.

The company also wanted a cycle basis which was stricter and shorter than that under the old methods. It felt it important that the whole process—from the time

of receiving orders through invoicing, preparation of merchandise in the warehouse and loading ready for delivery—should be completed within 48 hours.

And finally they wanted a perpetual warehouse stock inventory of a high standard, plus other by-product information which an improved system could provide to help the merchandising department, the sales director and his people.

TOO MANY BODS

While these requirements and decisions were crystallising, the planning chiefs were also considering the equipment for the new system. They looked at all sorts of conventional methods and always arrived at the same conclusion—that with these methods there were too many decisions to be made, too many people involved.

'When we considered the bulk of the merchandise we had to handle, the necessity for fair and even distribution throughout the branches and the number of decisions and calculations which would be involved, we decided that the flow of our thinking should be towards some form of computer,' said Mr Roxburgh.

'We met three of the companies and decided that Bull could offer the machines for our job, on suitable terms and, importantly, with delivery dates to fit our timetable.

'We chose Gamma 3. And we decided to rent rather than buy because we felt that this would give us a more flexible approach to possible future needs. Also purchase of the machines would mean tying up a lot of capital which can give us a better return if invested directly in our business.'

From the choice of Gamma 3 to actually going into operation on the machine (not merely program testing) took just nine months.

That is not bad going. How was it done?

'It means hours and hours of discussion, of course,' said Mr Roxburgh. 'It meant literally setting aside days for discussion and being prepared to meet at any time. Four of us also went over to France to the Bull plant and also saw Gamma 3 working on jobs roughly similar to the one we envisaged.

'It meant co-operation from Bull, and co-operation all the way round. Because it is a complete system, you can't put in a machine like this in isolation. Every department must know the full story. If any department puts forward a reasonable requirement and it can be met, it should be. From the beginning we had in everybody concerned, all sides of the business.

'Other firms seem to have used a limited number of people to see this sort of thing through. We tended to have a lot of people—eight or more at a full meeting—and we did not find it a disadvantage. Instead of forming sub-committees, we co-opted anybody we wanted into our small fixed committee.*

'We also found a lot of things we thought we could never do, but when you're keen to find ways you very often can. Bull sat in on most of our meetings. At others we decided what we wanted and took it to Bull to see whether and how it could go on the machine.

'One thing we found essential—minuting accurately anything that might be relevant to further discussions. And we also made a practice of advance-listing in detail the aspects which had to be tackled at each forthcoming meeting.

'One can't over-emphasise that in planning like this you must take yourself down to absolute detail in the definition of the problems and, subsequently, in how you are going to answer the problems.

'The outcome of all our talks was the production of a complete statement of the problems, all our needs and the possible answers, and this was presented to the programmers who were going to do the job.

Now that the system has been operational for some time we can say that the prime objectives we defined have been achieved. In other words, they are what we envisaged, though, of course, we are still polishing and improving and hope to go on doing so.'

RISK PAID OFF

In the application of the system at branch level a bold decision solved two problems at once—the minimisation of clerical work, since the branches have no clerical staff, and secondly the conversion of branch information to machine language.

'We took a risk—and it is paying off,' said Mr Roxburgh. 'We decided that branches would mark the input cards for the machine and the machine system would do everything else.

'The cards go out prepunched to identify the branch, its grade and the type of card. All branches have a specific day of the week for marking their cards and despatching them to the machine room at Bracknell—so that the machine, working five days a week, has a regular daily flow of cards.

'The branch receives availability lists—lists showing the lines available in the warehouse—which are in the same layout as the cards. The branch notes its stock of these lines onto the availability lists (disregarding any stock it is holding which does not show on the lists) and then marks its stock for each line on to the input cards.

'You'll note that the branches are not required to calculate their orders or to list their registered stock. All they do is list the stock they hold. 'Sadie' checks this against their registered stock and so, quite simply, determines the demand.

'All that is required of the

* The core of the committee represented the merchandise, distribution and accounting sides, with three directors—deputy chairman and sales director Ian Farmer, general manager Jack Barber, who is, of course, responsible for distribution, and David Roxburgh, plus John Greenhill, the O and M manager.

branch staffs is to check that they have the right departmental card and that it agrees with the availability list and then, using the special pencil with its special lead, make small firm crosses in the appropriate squares on the cards.

'The cards sent to Bracknell are thus already in machine language. Their marks have only to be magnetised before they go into the machine.'

Delighted as they are that their calculated risk in card-marking has proved a winner, the Bracknell people do not minimise the intense training effort that went to its success.

Branch staffs have been disciplined in using some sort of card with care and respect through the firm's operation, since 1956, of a Kimball sales tag system. But the marking of the Bull cards naturally involves much more.

Headquarters made a colour talkie film on how to mark cards and then organised a series of regional courses with executives and branch management staffs throughout the country. They took the morning sessions for explanation and demonstration and then had practical sessions with the managers marking the cards themselves. Then the managers went off and trained their staffs in the same way.

The work of Dorothy Perkin's computer system follows a simple cycle which is repeated several times in one week.

First, marked cards from the branches go through a magnetic reader-punch which first magnetises the marks so that these can be read and thus activate the punch. The machine checks to see that they are properly punched and selects any incorrect cards for correction. Then the information in the punched cards is transferred to the computer's drum store.

This run accumulates the total demand for all lines from the branches so that it can be compared with the quantity of stock available in each line in case a 'restrictive allocation' has to be made. Where stock is short the system works out the allocation among that day's branches so that all shops get a fair bite of the cherry. The system has previously decided how much of the total stock balance is available for the branches sending in their cards on the particular day so that this 'fair shares for all' policy works throughout the week.

A second phase of the cycle is the invoicing run and this is the first time the system takes account of prices. Having worked out the quantities to be sent to each branch—by garment definition size and colour—it now works out the allocation, on each branch's order, of the garments available at the different prices which occur within a single garment definition, again in such a way that all shops have a fair share of the differently prices goods in the warehouse.

On this run too are produced the invoices for each branch—in the same format as the original cards; at the same time the warehouse stock balances which are held on the drum are adjusted so that these are continuously up-to-date.

The invoices then go into the warehouse where operatives pull the stock and put it into special containers of the new conveyor system to be carried around to the appropriate point in the packing department for despatch by vans.

That then is the cycle in outline. And of course the system produces additional information as a by-product of this cycle.

It produces a full daily warehouse stock list in quantitative terms (garment definition, size and colour) which high-lights exceptional stock balances compared with pre-determined maximum and minimum levels and thus gives warning of overstocking or understocking.

It provides a quantitative daily despatch list giving total despatches, for the merchandise department.

It produces a weekly stock list showing everything—prices and monetary value as well as garment definitions, sizes and colours.

And the daily despatches can be combined into a weekly statement by the use of summary punched cards.

Apart from the high degree of training in card-making and outlining to their staffs in general terms how the system works, Dorothy Perkins have been at some pains to explain to their branches that all allocations—both of short-supply goods and of differently priced goods—are strictly in accord with the policy of even distribution.

'They are carefully worked out to ensure that they are as fair as humanly (or electronically) possible,' say the company's executives.

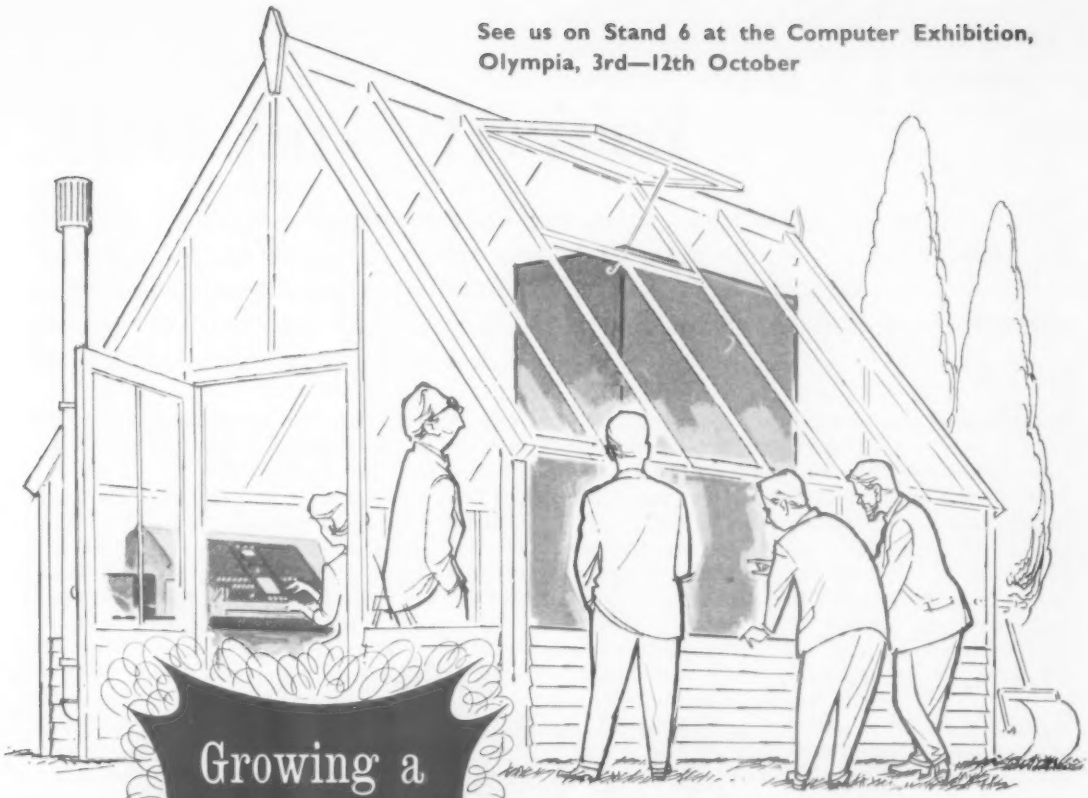
Among the flexible features built into the system, one permits a branch to send in a note with its card specifying that it does not want a certain size or price or colour of any particular garment. And the same feature can cope with special circumstances which cause detail variations in the general grading of any of the branches.

Provision is also made in the system for the main invoicing program to be overridden and for the machine to invoice pre-determined quantities to branches with or without designated prices. Where prices are designated the normal price allocation program is overruled. This arrangement enables the merchandise department to arrange special deliveries where appropriate or to 'grade out' small remaining balances of stock.

The input medium is again the mark-senser card marked by the staff in the merchandise department giving details of code, size colour (with price marking optional).

These special cards are not mixed in with the cards prepared by the branches for the general invoicing run, but are dealt with as a separate machine run.

See us on Stand 6 at the Computer Exhibition, Olympia, 3rd—12th October



Growing a computer...

You're managing a successful business and you've heard that computers can help you reduce all that untidy paperwork, perhaps even save you a pound or two. Philpotts have one. Doing very nicely they say, but it's so fast that they're running out of work for it. They say it cost a packet.

Jenkings Mail Order have had one for a couple of years but it's having to turn work away. They bought a small one and it's reached its limit, what with all the payroll, stock control and invoice problems they're asking it to do.

How can you think of buying one when you hear so many conflicting reports? But you feel you ought to be doing something about it—not just because it's the 'OK thing' to buy a computer this year—but you've a sneaking suspicion that there might after all be something in all that talk about electronic data processing, high speed access times and ferrite stores.

After all, the days of the dabbler have gone; the people who are buying computers these days are hard-headed business types and who would deny that you are a hard-headed type?

Down at Newport, Mon., they GROW computers for you, to any size you need. You can start with a compact thirty-thousand pounds job which ought to keep you happy for a while—maybe for a lifetime. Once you've got it and it's become a full-time member of your staff, you might find you need a bigger one. So you ring STC.

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system will grow until it's worth a couple of hundred-thousand! Yes that sounds a lot, but not if you consider that by that time it will have more than paid for itself.

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Compagnie des Machines Bull — one of the world's largest manufacturers in the data processing field — have provided installations for Fiat in Italy, Carlsberg in Denmark, Siemens in Germany, The Belgian Post Office, the Banks of Brazil and Mexico. . . .

Here in Britain, De La Rue Bull are adding new names to this international list: Boots, Colvilles, Dorothy Perkins, British Olivetti, the Royal Exchange Assurance, Shell. . . .

De La Rue Bull are taking part for the first time in a national exhibition in this country.

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A SPECIAL SURVEY

ADP has Arrived

Computer installations so commonplace they are no longer news . . . . an opening-up of the computer market beyond all expectations . . . . automatic programming, magnetic filing and other developments well advanced . . . . these are the dominant features of the computer landscape, three years after the first Electronic Computer Exhibition.

THE difference between the 1958 and 1961 electronic computer exhibitions can be summed up in two words: *promise* and *achievement*. It is not merely that the 1961 exhibitors will put on the inevitable ' dazzling display of technical advances '—new equipment which, in every respect outstrips its counterparts in 1958. Visitors will still see plenty of prototypes and, in some cases, will be invited to order machines ' off the drawing board '. The real difference is that most of these new developments are the outcome of working experience. Manufacturers not only know what their customers want to do; they also know what their customers *can* do if given the right tools.

Too much has been said and printed about the teething troubles of this new business activity. The golden age of electronics may contain more base metal than was originally claimed; but it is just as facile to imply that every computer user has been disappointed by the first results.

WHO'S USING ADP

In 1958 any reasonably knowledgeable person could have produced a short list of computer users without reference to published reports. It would simply have contained the ' household ' names of firms which are traditionally associated with the development of new methods and techniques.

This situation has now changed. The biggest change is that today's much-extended list contains names which many businessmen have never heard of.

Not that anyone has produced a complete list. It is even difficult to estimate the total number of computers now doing commercial work in Britain. This is partly due to the high proportion of borderline cases (electronic calculators which do not really qualify for the term ' computer ') and partly to the reluctance of manufacturers and users to reveal information until things have got to a fairly advanced stage. Above all, it is a sign that computer orders and installations have become so commonplace that many of them are never published in the press or even talked about.

There is evidence, however, that between 200 and 300 stored-program machines have been installed for some kind of commercial use.

Practically all industries and branches of commerce are represented, some more heavily than others. Several industries which have held back in the past are now busily ordering machines—the insurance industry is an example. Others, like building societies, are still rather hesitant. Recent activity among public utilities and municipal authorities suggests that they, at least, are convinced that data processing can be profitably applied to routine clerical chores.

The market for computers in Britain is larger, it seems, than many people forecast. Some of the biggest of the potential users are still concerned only with pilot installations. The banks, for example, are mostly trying out single machines on a purely regional basis; but at a later stage the Big Five, at least, can be expected to order computers by the dozen. There are also opportunities for relatively small businesses to make use of ' electronics '.

It is wrong to suppose, however, that the greater variety of users is primarily due to the development of smaller computers. In fact, many of the smaller systems now being sold are much more powerful than their rather clumsy predecessors. Any scaling-down has been in physical dimensions and cost, rather than in performance.

In 1958, most of the current users had graduated from punched cards. Today, many computers are taking over work which was previously done on unit accounting machines or even manually. This is a clear sign that computers have brought a new degree of flexibility to commercial operations, and especially to the compact storage and quick retrieval of day-to-day bookkeeping information.

CURRENT APPLICATIONS

Payroll today—but tomorrow, ' better information for management '. That was the story in 1958. Has it changed?

Here is a quick analysis of the main jobs which are currently being run or planned by a fairly representative group of 100 computer users (excluding such special cases as banks).

Payroll accounting	50
Stock control	35
Invoicing	20
Sales accounting & analysis	15
Costing	14
Production control	13
Operational research	12
Revenue accounting	9
Production scheduling	7
Budgetary control	5
Distribution of supplies	3

This analysis cannot be taken too literally, since it ignores ancillary operations and the development of integrated systems; also, there is the difficulty that certain job-descriptions are given different interpretations by different firms. Nevertheless the results broadly support a number of conclusions formed as a result of direct observation in specific (and fairly ' typical ') cases.

▶Many computers have taken over ' bread and butter ' jobs, presumably without radical changes in the end-product of these. In spite of what the pundits say, this is not necessarily a bad thing. If a computer is ultimately to help management by providing ' better facts ' for planning and control, it might as well start by dealing with the day-to-day records from which those facts will be deduced. But the *ad hoc* approach can only be condoned if it is considered as a *first* step.

▶Stock control is high up the list because it is one of manufacturing industry's biggest chores and often involves a great deal of manual labour. But there is reason to believe that many of the firms developing systems of this kind are equally concerned with (1) the prospect of reducing their inventories and thus freeing capital and storage space; and (2) anticipating their customers needs more effectively and thus providing better service.

▶The low scores for production scheduling and budgetary control—on which computers obviously excel—seem to imply that industrial management is still rather possessive about traditional decision-making responsibilities. Nonetheless, the relatively high score for operational research may be accepted as a sign that such matters are now being investigated more closely.

Statistics never tell the full story. While there are some firms which use computers purely as clerical ' workhorses ' (because ' workhorses ' are what they really need), more and more businessmen are not only saying that computers can provide new kinds of information but are also finding how to use such information when they get it. Compared with the present picture, the prospect is immense; but as in any other young enterprise, ' the best is yet to come '.

It would be unrealistic to expect the average computer user to draw up a profit and loss account at this stage. Some have already achieved substantial savings in clerical labour (genuinely covered by the euphemistic phrase ' non-replacement of normal staff wastage '). But if a computer eliminates X clerks, the savings are not confined to their salaries. Other factors which have to be taken into account are the cost of recruiting X clerks, or of not being able to recruit them when they are needed; the cost of accommodating, training and supervising them; and also the hidden cost of putting right the mistakes which they periodically make. Finally, there is the value, potentially great, of being able to do things which X clerks, using conventional equipment, could never do economically or in time for the results to be useful.

DATA PROCESSING CENTRES

In 1958 there were plenty of computing centres, and plenty of talk about the value of commercial data processing ' laundries '. But the centres themselves were largely concerned with technical work, or with demonstrating machines to prospective customers.

The ' laundry ' idea is now becoming a reality. Firms wishing to free themselves from routine clerical chores can do so. Similarly, there are opportunities for small businesses to secure some of the benefits of ADP—particularly in respect of ' better management information '—without digging into their pockets too deeply.

A number of centres, including those run by Leo Computers, ICT, NCR and IBM, are now handling commercial jobs on a daily, weekly or monthly basis. Examples are: payroll accounting, covering about 4,000 employees, for a branch of a public utility. Daily labour and machine efficiency calculations for a metallurgical organisation. Preparation of monthly stock and sales statistics for an electrical firm. Production of monthly balance sheets and profit and loss accounts for about 60 operating units of an international organisation. Weekly sales analysis for a small manufacturer of electrical fittings.

Stockbrokers, actuaries and insurance companies have been particularly quick to recognise the value of data processing laundries. The demand for this specialised work is growing rapidly. In July, International Computers and Tabulators opened a City computer centre (although at present this seems to be based on punched card equipment). NCR have installed an 803 computer with magnetic files in one of the City's new skyscrapers, and are developing a full-scale service dealing exclusively with the work of stockbrokers and others.

Most computer manufacturers also provide ' launderette ' facilities. A notable development in this direction is the ' Data Centre ' opened in June by IBM United Kingdom Ltd; clients write their own programs and operate the machines. While the accent is on scientific and technical calculations,

there are similar opportunities for commercial work. This development follows IBM's success with a chain of Data Centres in the USA.

The machines at the IBM centre are also being used by Britain's first independent computing service, CEIR (UK) Ltd, who began operations about six months ago.

DEVELOPMENTS IN HARDWARE

About 20 new computers have been announced in Britain since the first exhibition closed its doors. About two-thirds of them are being offered as data processing systems, in many cases with specially-designed peripherals whereas most of the 1958 exhibits bore a strong family likeness to the scientific machines from which they had been developed often rather hastily.

The newcomers included the Ferranti Orion, Leo III, IBM 7070, IBM 1401 and 1410, NCR 315, English Electric's KDP 10, ICT 1301, the Stantec Data Processing System, National-Elliott 803, and the Bull DP 300 series.

Using transistors and other solid-state devices, these 'second generation' machines are generally faster, more compact and more reliable than their predecessors. Ferrite cores provide the main form of internal storage, but are supplemented in many cases by the now slightly old-fashioned magnetic drum.

Computing speeds are much higher—although the most spectacular increases in speed have been restricted to large machines primarily built for scientific use. A 'nutshell' report on developments in the design of central processors must also mention such things as more flexible methods of control, time-saving improvements in 'addressing' systems, and better error-detecting devices.

To the businessman, however, such advances are not necessarily the most important. Commercial data processing is largely a matter of doing lots of little sums in quick succession; and for this reason the prospective user is primarily concerned with the development of better ways of getting large quantities of data into and out of the central processor, and of storing business records in a compact, economical and readily accessible form.

Fortunately, much of the development work of the past three years has concentrated on these important areas. Computer manufacturers are now dancing to the tune piped, with steadily increasing confidence, by commercial firms; the customer is no longer expected to 'bend' his requirements so that he can make use of equipment designed for entirely different purposes. Together, the new systems demonstrate that considerable advances have been made in: designing peripheral equipment to meet the needs of all kinds of business; developing 'time-sharing' techniques so that the high speed of electronic processing can be exploited more fully; simplifying the writing of programs by getting away from the idea that the only means of communication between man and machine is a strictly mathematical language.

INPUT DEVICES

The ideal, of course, is that computers should read normally-printed documents. Technically, this has been achieved; in a practical sense it still belongs to the future.

MICR (magnetic ink character recognition) has certainly arrived in Britain. Three banks have already installed automatic cheque reader/sorters. But for the time being this equipment is concerned only with 'in-clearing' (distributing the bank's own cleared cheques to the branches which issued them) and is right outside the field of electronic computing. Moreover, the current work is largely experimental, since the Banks' Electronics Sub-committee has still to fix standards for the MICR type-line on which the sorting is done.

The first British optical reading system, based on Solartron equipment, has been temporarily abandoned because the prospective user, Boots Cash Chemists, decided to do the work in a different way. But similar systems are being planned or developed. Moreover, other manufacturers, including IBM and NCR, are now coming up with promising equipment. One optical reader, made by the American Farrington Corporation, has already been demonstrated in Britain by their associated company Adrema Ltd; it has the distinction of being the only device of its kind with real working experience (American) behind it.

To simplify the 'logic' of automatic reading devices and to make them more reliable, all manufacturers seemed to have plumped for rather stylised type founts. This means that the use of optical character recognition is feasible only where the documents are originated by the organisation which is eventually to process them. There are two main fields of application: (1) dockets produced at branches and sent to central processing units and (2) 'turn-round' documents (*eg.* specially-printed bills which, when returned with remittances, become input for an automatic account-posting routine).

Much progress has been made with more conventional methods of input. Punched paper tape has become increasingly popular. This is partly due to its convenience and low cost; partly to the fact that current systems have less affinity with orthodox forms of punched card processing (because of their relatively small capacities, many first-generation machines more or less depended on mechanical methods of pre-sorting input data). Tape reading speeds of 1,000 characters per second and over are now commonplace.

One weakness of computers is that they are virtually impotent until the new input data has been entered, character by character on a keyboard. With conventional tape punches, this manual work is usually done twice—the second time for verification. Consequently there is a rapidly growing interest in the idea of using automatic punches electrically coupled to standard business machines. In this way, much of the punched data is verified by normal accountancy checks. Also, there is the big advantage that tape-punching becomes an automatic by-product of operations which are themselves productive, since they provide printed records for local reference and action.

OUTPUT PRINTING

High-speed printing is the key to successful ADP operations where business documents, such as invoices, have to be mass-produced. It must be admitted that in this field of development manufacturers have stolen much of their own thunder. Over five years ago some of them were talking about printing speeds of 1,000 lines per minute or more, whereas the current level is generally about 600 lines per minute. However, the current machines differ from their predecessors in one rather important respect—they exist and work.

Designers have had difficulty in making the mechanical parts of high-speed printers as reliable as the 'electronics', some of the early models proved so troublesome that stand-bys were almost essential. But there is now plenty of evidence that such problems have been resolved by adopting different principles of construction.

One exception to the general speed-level is the Xeronic, which employs a 'photographic' method of reproducing matter thrown on to a cathode ray tube by the computer. This machine illustrates the 'achievement' which has followed the 'promise' of the first Exhibition. In 1958 it was rather tentatively demonstrated as a 1,500-line-per-minute prototype; this month it will be seen as a production model working at 3,000 lines per minute.

FILING MAGNETICALLY

Magnetic tape has revealed certain basic limitations and for this reason much effort is being put into the development of memory systems which permit some form of 'random access'.

Core storage would provide a simple answer—but for its expense. Therefore current developments mostly involve mechanical devices.

The first device of this kind was IBM's Ramac system. Mechanical arms, equipped with read/write heads, are used to locate information stored in a stack of magnetic discs. This equipment is already working in Britain, and the manufacturers have recently introduced an improved version.

NCR's new Cram unit approaches the problem from a different angle. In this case, information is stored on a series of magnetic cards, any of which can be selected mechanically. After selection, the card is momentarily wrapped round a drum which carries it under a row of read/write heads.

Another type of random access memory, employing magnetic tape, has been developed by a Swedish firm and taken up, on an agency basis, by Associated Electrical Industries.

It is believed that other developments are under way and are likely to produce tangible results in the near future. Whether they involve the use of large magnetic drums—toyed with by several manufacturers—or something new, remains to be seen.

Meanwhile, the development of 'thin film' methods of data storage have been hailed as a major breakthrough in this field. Largely developed in Britain—ICT are prominent in this field—they are already being featured in an American computing system, the Remington Rand 1107 computer, announced a short time ago. Whether it will be made available in Britain is not yet clear.

AUTOMATIC PROGRAMMING

The time will come when business computers can be instructed in something like ordinary business language. Some progress has been made in this direction since 1958 but there is still a long way to go. One snag is that many of the phrases used in business are disconcertingly imprecise.

Current hopes are centred on COBOL, originally 'sponsored' by the US Department of Defence and now being taken up by a number of computer manufacturers in Britain and the USA.

But despite the obvious attractions of a truly common programming language, the work of individual computer users is not seriously handicapped by its absence at this stage. Much effort has been put into the development of autocoding systems for specific ranges of equipment—examples are NCR's NEAT, IBM's FORTRAN, Standard Telephones' SEAL, and Ferranti's NEBULA. The real upshot of this development work is that today business computers are much easier to program than they were a few years ago.

EVERYONE INTERESTED

ADP has arrived. It has already done a great deal of real work for many British businesses. For this reason, the exhibition that opens on October 3 will be much more of a business event than its predecessor. Then ADP was of direct interest only to the big firms which were ready to put up with the trouble and expense of being first in a new field. Now, it is of direct interest to almost everyone. There is hardly a businessman in Britain who can say with certainty that during the next decade his daily work and responsibilities will not be affected by such developments.

Makers, machines and milestones . . .

A brief scrutiny of the activities of individual computer manufacturers throws into relief developments and achievements notched up since the first Electronic Computer Exhibition in 1958.

Associated Electrical Industries Ltd

Starting-point in this company's computer operations was the small 950, designed and built by Metropolitan-Vickers about five years ago. Just before the first Electronic Computer Exhibition the company announced that they were working on a new solid-state system. This has now appeared as the AEI 1010.

AEI say that it can control up to 32 peripheral units simultaneously, which may account for its unusually wide price range of £125,000 to £750,000.

The first order (reported value £600,000) came last year from the Air Ministry, who will use the 1010 to control the distribution and issue of supplies throughout the world. A 1010 has also been installed in a data processing centre set up at Sale, Manchester.

In July this year, AEI announced that they had become sole agents for Britain and Commonwealth for various peripherals made by Facit Electronics of Sweden. These include the Carousel random access magnetic tape memory, which is to be demonstrated at the Exhibition.

A Carousel unit can hold over 3 million alpha-numeric characters or over 5 million decimal digits. Access time for each block of data averages about two seconds.

Burroughs Machines Ltd

This company (who changed their name from Burroughs Adding Machine Co. a few months ago) entered the British computer market with a small scientific and statistical machine, the E101. Built in the USA, this had pinboard programming and punched paper tape input and output. Two machines were sold—one to Gloster Aircraft and the other to British Petroleum.

Since then the British company seems to have stood on the touchline. From time to time, they have announced or demonstrated EDP equipment placed on the American market by their parent company. The latest announcement concerns the medium-sized, solid state B5000 system.

A variety of bank automation equipment has been demonstrated in Britain and some units have been sold, including a cheque sorter.

De La Rue Bull Machines Ltd

This firm is one of the two newcomers since the first Electronic Computer Exhibition. It was founded last year by the already well-diversified De La Rue organisation (plastics, bank notes, etc.) and one of Europe's most successful computer manufacturers. The main object is to make complete installations of the French-built DP equipment which has hitherto trickled into Britain in the form of peripherals—for example, the Bull line printer.

Current activity is centred on three systems: the 300 DP series; the Gamma 3 (an all-purpose computer with drum storage); and the big Gamma 60.

The 300 is now making its first appearance in ' computer form '. Developed from an established range of punched card equipment, it consists of a number of independent electro-mechanical and electronic units working under the control of a master program unit. These independent units include card reader, card reader/punch, printer, either electric or electronic calculator, magnetic drum and magnetic tapes. All are of modular design and can be added to on site if required. The electro-mechanical devices work at a uniform rate of 300 cycles per minute, but since different operations can be performed in parallel the overall speed of the system is considerably higher than this.

A 300 DP system is due for delivery to the Royal Exchange Insurance Co next year. They already use a

YOU CAN HAVE IT BOTH WAYS

not only will the Addo-X punched card link give you documents and punched cards simultaneously, but it can also give you a 'low budget' punched card system for analysis and summarization of the cards, on the same machine.

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Gamma 3 and were in fact the first British concern to be supplied by De La Rue Bull.

Gamma 60 is said to be one of the world's largest data processing systems. Several installations are already working on the Continent.

Elliott Brothers London Ltd

Apart from their collaboration with National Cash, Elliott Brothers have an interest in scientific computing and industrial process control.

They were among the first British companies to design and manufacture computing equipment. Their development work on such things as ' packaged ' construction made important contributions to this new technology.

Since 1954, over 120 machines of 10 different types have been installed. Elliotts have been notably successful in the export field. Some are doing on-line calculations in process control systems supplied by another member of the Elliott-Automation Group.

A new development is the 500 series. The 502 is an on-line processor with special applications in such fields as aircraft flight simulation, traffic control and seat reservation. The 503 has been designed for general-purpose use in science, mathematics and industry; it employs the 803 machine instruction code.

EMI Electronics Ltd

EMI are in the unique position of being the only British computer manufacturer which started operations with a solid-state machine.

The Emidec 1100 system made its first public appearance at the 1958 Electronic Computer Exhibition, and during the following year the company announced a substantial number of orders. The first machine was installed by Boots Cash Chemists at Nottingham last autumn. Since then deliveries have been made to ICI (Plastics Division), Glaxo Laboratories, British Motor Corporation (which had previously taken delivery of a special payroll computer designed and built by EMI, the Ministry of Labour, the Air Ministry, Sainsbury's and Barclays Bank. Another 1100 has been installed at the Manchester Square, London, offices of an associated company, EMI Records, where it is being used for royalty payments, payroll and cost analysis, as well as for demonstrations and service work.

The Barclays machine was installed about three months ago in a specially-built computer centre. It is now taking over the processing of customers' accounts for 12 of the bank's London branches. Account data are punched into paper tape at the branches by automatic punches electrically coupled to keyboard accounting machines (which produce journals for branch use) and then transmitted to the centre by teleprinter. After the files, kept on magnetic tape, have been updated, reports are sent to branch managers over the network.

Under the sponsorship of the National Research Development Corporation, EMI have also produced a larger data processing system, Emidec 2400. Machines of this series will be delivered to the Royal Army Ordnance Corps and the Ministry of Pensions and National Insurance, Newcastle-upon-Tyne.

English Electric Co Ltd

With Deuce, a medium-sized valve computer developed from the National Physical Laboratory's Ace, English Electric scored their first successes in the scientific and technical fields. Over 30 of these machines have been in use for some time, about one-third of them in the manufacturers' own establishments. A commercial version, employing Decca tape units was planned but never delivered, except for an installation at one of the company's computing centres.

For their main attack on the commercial market English Electric took advantage of their long association with the Radio Corporation of America and imported the blueprints of an RCA computer. The result was KDP10, a solid-state system costing from £150,000.

The company's sights seem to have been set initially on banking, insurance and public utilities. Each of these targets has been hit once already, with sales to the Commercial Union group of insurance companies, the Yorkshire Electricity Board (which is to install a £300,000 system at Seacroft, Leeds, for consumer accounting, payroll, stock control and cost analysis) and the Midland Bank.

Offered with the KDP10 is a range of sophisticated peripheral equipment, including a line printer operating at between 500 and 600 lines per minute. The first system should be delivered this month to the company's data processing centre at Kidsgrove, which already uses two Deuce computers.

About a year after the introduction of KDF10, English Electric announced a machine of their own design, KDF9. This exceptionally fast computer has a bias towards scientific applications but is also intended for commercial data processing. For the De Havilland Aircraft Company, which has ordered a twin system, it will handle both production control and engineering design calculations.

English Electric's newest computer is the low-cost KDN2 based on the company's established ' Datapac ' units. This is designed for process control and ' smaller scale industrial and general data processing '.

Ferranti Ltd

At the time of the first Electronic Computer Exhibition, Ferranti had delivered 37 machines—more than any other British manufacturer. Since then they have lost this purely numerical lead, but doubled their score.

Their initial success was scored with the Mark 1, introduced in 1951 as a result of development work at Manchester University and claimed to be the first commercially-available computer in the world. Then came Pegasus, a smaller general-purpose machine (equipped with magnetic tape files in about one-third of the systems now installed), followed by the Mercury scientific

The overall average speed at which your computer tape passes the heads of this machine determines the through-put of your computer installation, and its efficiency. Just as in a good road racing car, high top speed is not enough. Both machines must be able to reach speed quickly and stop quickly, in order to maintain a high average. This is where the British-made Ampex TM.2 excels. Reliable start times of less than 2.0 milliseconds to plus or minus 10 per cent of nominal speed, and stop times of less than 1.5 milliseconds assure maximum through-put and, at the same time, minimise dead space on valuable computer tape. This exceptional performance, achieved without any sacrifice in machine reliability or tape life, derives from the TM.2's advanced electro-mechanical design based on three years' extensive field experience with the Ampex FR.300 Computer Tape Handler. As with other Ampex equipment, the TM.2 is backed up by a competent organisation of sales and service engineers, both in the United Kingdom and on the Continent. Parts are immediately available from Ampex Electronics Limited. The sound design and advanced capability of the new Ampex TM.2 is attested by the fact that nearly every major British and European computer manufacturer has already selected it for high-speed on-line use in their systems.

For complete technical specifications and full details of performance data on the TM.2 and on Ampex 800 Series Computer Tape, write for literature packet TM—44B to: Ampex Great Britain Limited, 72 Berkeley Avenue, Reading, Berkshire. Telephone: Reading 55341. AMPEX

Ampex TM.2 maximises computer through-put

computer. Although Pegasus is a valve machine it has had a remarkably long life, and several orders for it have been announced quite recently.

New additions to the Ferranti range are Atlas, a very fast machine and one of the most powerful in the world and Orion, which can be used with any of the peripheral equipment now commercially available in Britain.

Ferranti put a lot of development work into a commercial data processing system called Perseus, which was eventually installed by insurance companies in Sweden and South Africa. The pay-off has come in the form of orders for Pegasus II and Orion systems from a number of British insurance companies, including Prudential, Norwich Union, London and Manchester, and a subsidiary company set up jointly by the Scottish Widows Fund and Life Assurance and Standard Life Assurance, Edinburgh.

Orion was announced towards the end of 1959. By the end of the first year Ferranti had taken about a dozen orders for this machine, representing a total value of well over £2 million. Prospective users include the National Provincial Bank, the Beecham Group, the Metal Box Company, A B Turitz & Co—a Swedish chain store firm—the National Institute for Research in Nuclear Science; and the Agricultural Research Council.

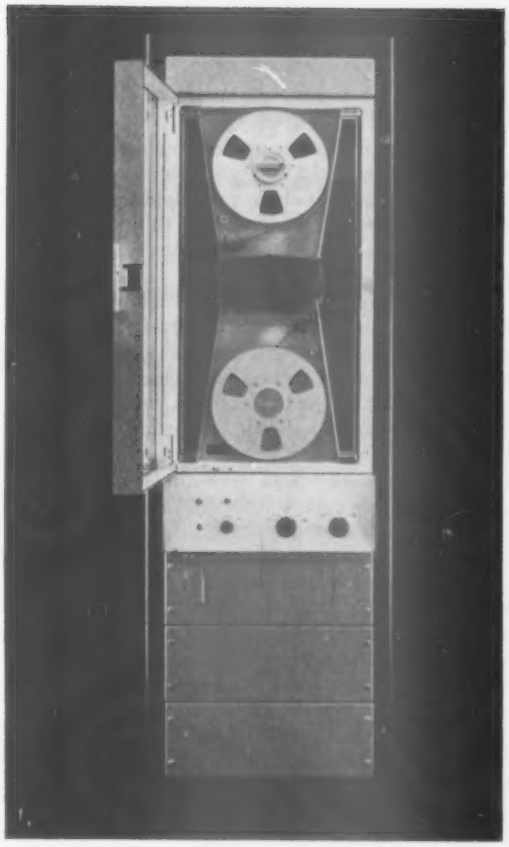
An Atlas computer is to be installed at Manchester University and another at Harwell.

Ferranti have also produced two small transistorised computers. The first is Sirius, a desk-sized machine with both scientific and commercial applications (the Builders Copper Tube Co plan to use one for invoicing, stock control and sales and cost analysis). The second is Argus, intended for process control. In this case the prospective users include ICI (to control a chemical plant at Fleetwood, Lancs) and the Central Electricity Generating Board (to control the starting-up and shutting-down of West Thurrock power station). Typical cost of an Argus system is £60,000. Another recent development is the Apollo computer for air traffic control.

Honeywell Controls Ltd

Because so much has been said about the ' intense competition ' in the British computer industry, it came as something of a surprise a few months ago to find that this well-known electrical engineering firm was ready to try its luck as a late-starter. But Honeywell Controls Ltd, British subsidiary of the Minneapolis-Honeywell Regulator Co, seem confident that their new electronic data processing division can win a useful slice of the British and European market for all-purpose computers.

Two models are to be manufactured at the company's Lanarkshire and Hertfordshire factories. The Honeywell 400 is a medium-sized system which costs about £140,000 for an average installation. The 800 is a medium-to-large system costing about three times as much. Both use the same peripheral units and are compatible.



NEW AMPEX TM-2

Among the world's major computer manufacturers who have achieved maximum computer through-put by incorporating TM-2 digital tape handlers in their data processing systems are:

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FERRANTI LTD
INTERNATIONAL COMPUTERS AND TABULATORS
LEO COMPUTERS LTD
NATIONAL CASH REGISTER

See the TM-2 on the Ampex Stand (No. 41) at the International Computer Exhibition, Olympia, London, October 3-12. Ampex Great Britain Ltd

The first British-built systems should be ready for delivery before the end of next year.

IBM United Kingdom Ltd

IBM's world-wide stake in the computer business is well-known. The British company made a comparative slow start but there have been many developments since Rolls Royce installed the first IBM 650 in 1955. So many, in fact, that it is difficult to compress them into a short report.

On the commercial side, IBM find that most of the firms ordering their computers have had punched card experience. Orders are still being placed for the 650 (Prudential Assurance and the Steel Company of Wales are recent examples) but the emphasis has now switched to the solid-state 1401 system, announced in October, 1959. Over 100 machines of this type have been sold in Britain—half of them with magnetic tape units—and over a dozen are already installed. Prospective users include ten insurance companies. The basic cost of a 1401, without magnetic tape, is about £50,000.

There has also been a number of installations (six this year) of the 305 Ramac system, using IBM's ' juke box ' random access memory. For its first British user, C and J Clark, the Somerset shoe manufacturers, this equipment has been doing order processing and stock control. Other users or prospective users include the Book Centre, Scottish Midland Guarantee Trust, Joseph Burton Ltd (chain store grocers), and Lloyds Bank. The capacity of the random access unit has been enlarged and the average access time reduced since this equipment was introduced in 1958.

One of the largest commercial installations is the 705 delivered to the Royal Army Pay Corps this year. This machine did calculations for the 1961 Census of Population. Cost of the system was reported to be £750,000.

Since the last computer exhibition, IBM's range of electronic data processing equipment has grown considerably. It now extends from the 1401 and the more powerful 1410, to the 700 and 7000 series.

A new development at the lower end of the scale is the small 1620 system. Although primarily intended for scientific and technical work, this has commercial uses as well. Loughborough Technical College has already installed one, and at least two banks have placed orders.

In 1958 there was only one of the big IBM computers in Britain—a 704 originally installed at the United Kingdom Atomic Energy Authority, Aldermaston. Now there are several. The Central Electricity Generating Board are using a 709. Rolls Royce, Derby, have installed the first 7070. UKAEA have taken a 7090.

For some time IBM have run a service bureau in Wigmore Street. In June this year they opened a ' Data Centre ' in Newman Street. The fundamental difference between these establishments is that while the first does conventional service work the second provides computers (at present a 7090 and a 1401) and ancillary equipment for its clients' own use.

Other developments include a range of ' Teleprocessing' equipment for data transmission, improved random access storage units for the 1400 series, and a miniaturised punched card system, the 3000.

International Computers and Tabulators Ltd

When the British Tabulating Machine Company and Powers-Samas Accouting Machines joined forces in January 1959 each was making deliveries of small punched card computers. British Tabulating had developed the 1200 series (the first commercial model was installed by Morgan Crucible in 1956) and the 555 Plugged Program Computer; Powers had concentrated on the PCC (Program Controlled Computer).

The new company, International Computers and Tabulators, have since developed the ICT 1301, a fast, solid-state system which will be publicly demonstrated for the first time at Olympia.

The 1301 has been ordered ' off the drawing board ' by many organisations, including British Railways, Rubery Owen, SW Regional Hospital Board, London University, Institute of London Underwriters, Cadbury-Fry-Pascall of Hobart, Tasmania, and A B Elektroskandia of Sweden. A notable success has been scored in South Africa, where ICT are already firmly entrenched with punched card equipment; prospective users include South African Railways (three systems), an oil company and a steel tube manufacturer.

In the meantime ICT have installed a large number of 1200 series and PCC machines in Britain and abroad, also hundreds of electronic multipliers and calculators.

Leo Computers Ltd

The new, solid-state Leo III computer has one of the best pedigrees of all business data processing systems. It is a direct descendant of the ' Lyons Electronic Office ' set up at Cadby Hall almost exactly 10 years ago and fairly claimed to be the first of its kind.

The original machine still handles a substantial proportion of J Lyons and Co's clerical work.

Leo Computers Ltd, the manufacturing and marketing company founded at the end of 1954, have spread this basic know-how into other commercial fields. The first production model of Leo II was installed by Stewarts and Lloyds in April, 1958. Since then, machines have been delivered to a variety of organisations, including the WD & HO Wills branch of the Imperial Tobacco Company, The Ministry of Pensions and National Insurance, Ilford, Standard-Triumph International, British Oxygen Gases, and the Ford Motor Co.

Ford have taken two Leo systems. The first, delivered about 18 months ago, handles invoicing and stock control at their Aveley spare parts depot; the second, installed at Dagenham early this year, is doing payroll at present but will eventually take on production and stock control.

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The first Leo III will be installed at the firm's data processing centre at Hartree House, Bayswater. This system which can cost between £200,000 and £400,000, depending on peripheral equipment required, uses the American Anelex printer, which works at the rate of about 880 lines per minute.

A Leo III is due for delivery next year to the Dunlop Rubber Company, for whom it will do invoicing, stock control, production planning, payroll and sales forecasting. Others are going to CAV Ltd, manufacturers of electrical equipment, and to an oil company.

New technical developments by the British company include a machine which converts Kimball tags into punched paper tape at the rate of 150 tags per minute. Work also continues on a document reader, apparently based on mark-scanning principles, rather than on direct character recognition.

National Cash Register Co Ltd

Anxious to break into the computer field in the early days National Cash formed a working partnership with Elliott Brothers (London) Ltd whereby National Cash marketted Elliott machines for commercial applications. The National-Elliott 405 computer equipped with magnetic film memory units, shown at the first computer exhibition in 1958, was the first computer to provide large-scale memory filing at a time when British computers were still tied to punched card storage.

The 405 installed by Norwich City Council early in 1957 was Britain's first magnetic-file computer and, in fact, the first production model of any British computer to undertake routine clerical work. With their ' pioneering ' days a long way behind them, Norwich Council are now installing a larger 405 system.

Other 405 users include Courtaulds, North Western Gas Board, Reckitt and Sons, Newton Chambers and the GPO, Aibert E Reed and Littlewoods Mail Order Stores.

Anticipating the need for a smaller system, National Cash made arrangements to handle commercial applications of the cabinet-sized Elliott 803 computer. The versatility of this machine has now been increased considerably by the introduction of large-volume magnetic files—the 803 is the cheapest system in Britain to provide such facilities. Initial users include the South Eastern Electricity Board, G A Harvey and Co (London) Ltd, and Godfrey Philips Ltd.

In the USA National Cash have for some time been developing their own range of electronic data processing equipment. This has led to the introduction in Britain of the solid-state 315 system, which Elliott Brothers are to manufacture. Outstanding feature is a new kind of random access memory based on the use of magnetic cards and thus having the same ' expandability ' as a manual filing system. Its speed is such that any piece of information stored in a single interchangeable cartridge can be retrieved in under 200 milliseconds. Up to 16 cartridges can be coupled to the processor simultaneously, giving immediate access to about 88 million alpha-numeric characters. Another peripheral unit reads 80-column cards at 2,000 cards per minute.

A new development, to be shown publicly for the first time at Olympia, is the compact National Cash 390 data processing system, which employs special cards printed in both human and machine language. It is one of the few systems that produce multiple records (for example, payslips, earnings and tax record cards and payroll) while the processing is actually being done.

Remington Rand Ltd

In the United States, Remington Rand were the first manufacturer to install a business computer—the Univac I delivered to Metropolitan Life in 1954, and since joined by several other machines of the same series. But the British company have been something of a dark horse. Their electronics division, set up in 1956, has been handicapped by the lack of demonstration equipment. Recently, however, the dark horse has been shod by the installation of a computer at the new Remington House in Holborn. In Britain, Remington now offer the medium size USS 80 and the medium to large Univac III. Two orders have been received for USS 80 systems.

The parent company, Sperry Rand Corporation, have continued to make outstanding technical advances. One of the latest is the Remington Rand 1107, heralded as the forerunner of a third generation of computers. It employs a revolutionary ' thin film ' memory.

Standard Telephones & Cables Ltd

STC broke into the electronic computing business with the Stantec Zebra, a small valve machine (basic cost £28,000) developed in collaboration with the Netherlands Post Office. Over 40 Zebras have now been delivered, mostly overseas; the handful of British users include J Bibby and Sons Ltd, the Imperial Tobacco Co, and several technical colleges. Both here and abroad, applications are mainly restricted to scientific and industrial research.

From the start, STC have had their eyes on commercial data processing, and they now seem ready to get their hands on it, too. The recently-announced Stantec data processing systems are based on an improved, transistorised version of the Zebra, and STC are generally supposed to be developing a new kind of magnetic file. Meanwhile, they have sold about a dozen solid-state machines to non-commercial users.

Such developments have been somewhat overshadowed by success in the specialised field of airline seat reservation.

An order from BOAC was announced a few months ago. Initially this system will be confined to the Airways Terminal in London but future developments will take in ticket-selling offices all over Europe.

STC have also produced an ' aircraft payload and balance ' computer for use at individual airports. One of these is already working at Copenhagen.

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Taking the Industry's Pulse

ADP may have arrived, as a survey beginning on page 31 suggests, but leave aside the rose-tinted spectacles, and anomalies, muddled thinking, bad policies and tardy initiatives fairly bristle in the computer industry, according to Dr Andrew Booth of Birkbeck College, London.

THE past decade has seen the evolution of the electronic digital computer from a temperamental piece of laboratory apparatus, to an office fitment whose reliability is assumed to be the same as that of a duplicator or a typewriter. During this same period, too, a world trend has been visible in the manufacture of the machines and it is the impact of this trend which it is the purpose of this note to discuss.

In the first place it must be noted that the history of computer invention is an interplay between the old and the new worlds. Charles Babbage was responsible for the first overall design of a machine containing the units: arithmetic, storage, control, input and output; about 100 years later this work was followed by the analytic statement of fundamental computer necessities provided by A M Turing in 1936. From these two English pioneers the initiative passed to H H Aiken in the USA who actually constructed the first working all purpose digital computer, the ASCC or ' Harvard MkI '. Meanwhile von Neumann had laid the foundations of the whole modern art of the subject in the, now classical, ' Preliminary discussion of the logical design of an electronic computing instrument '. Von Neumann was a Hungarian, resident in the USA, so that his contribution can be regarded as a joint European-American one.

With the exception of Aiken, whose contributions did not lead to the foundation of any major computer manufacturing ' school ', none of the other pioneers were developing their machines to the point of manufacture, and it is interesting to notice that the now ubiquitous IBM declined to interest themselves in electronic computers as short a time ago as 1947.

Much of the initiative in computer manufacture was due to British firms. Thus, the first commercial machine was the old Mark I produced by Ferranti to the design of F C Williams; this was followed shortly by the Deuce from English Electric, the 1200 from the old

British Tabulating Machine Co (now ICT) and Leo I from Lyons.

It is interesting to notice that all of these machines originated in university, or semi-university environments whereas the history of development and exploitation in the USA was more the direct result of commercial enterprise.

Despite this clear start in the field, British computer firms did not maintain this lead. Many US firms entered the field and worked actively to produce a variety of interesting machines, and most of these were eventually offered for sale. One striking factor of the American scene was the willingness of manufacturers to make rapid use of technological advances. Thus American machines soon abandoned the valve for the transistor and had, from the start, facilities for using magnetic tape.

The picture in England was and is far less rosy. After, as usual, being in first and enjoying a sellers' market British manufacturers were slow to introduce technological improvements and, in this way, lost the initiative. It is a sad commentary on ' progress ' that the Ferranti Mercury computer, at the University of London is not provided with magnetic tapes, and was, until recently, restricted in its output to an old fashioned five-hole paper tape punch operating at 25 characters per second. This machine, purchased three years ago as representing the most advanced technical development in this country, is a valve machine.

It has been argued by manufacturers that the reason for not adopting sooner such things as the transistor was that the devices were experimental and unreliable. To some extent this is a valid objection, but the correct procedure was surely to have the advanced designs available and ready to put into production quickly when the components reached an adequate standard of performance. Instead of this, two or three years seem to elapse before we catch up with current American practice, by which time, of course, the techniques are already obsolete.

In the field of programming, too, the same sort of situation prevails. American manufacturers were supplying autocode systems with their machines at a time when British firms could hardly be prevailed upon to offer decent libraries of subroutines.

What are the causes of this situation? First, it must be said that most British manufacturers admit the truth of the assertions made above—this would be a hopeful sign were it not for the fact that they seem unwilling, or unable, to take effective action, and sometimes even seek to justify a maintenance of the *status quo*.

THE ROOT OF THE TROUBLE?

The attitude to new devices has already been mentioned, what is disturbing, however, is the complacency over long incubation periods. Naturally one can only argue from experience, but I am personally of the opinion that much of the trouble lies in the fact that the technical management and supervision in the industry is largely drawn (where it is technically qualified at all!) from the ranks of engineers trained in the disciplines of electrical power generation rather than those of electronics. It may be dangerous to generalise but, in my experience, the classical electrical engineer adopts a time scale based upon the inertia of a power station generator rotor rather than upon the time of transit of electrons! Much of the blame for this lies in the universities where the course of instruction for the BSc (Eng) degree is definitely 19th century in character and seeks to prepare students, not for productivity, but rather for membership of the older institutions. It is not even as though this curriculum and training is good within its own sphere, as an example will show. In the author's laboratory a large rotary convertor was to be installed; two first class honours engineering graduates, from Oxford and London respectively, spent three hours attemping to supervise and instruct technicians in getting the machine over a door-step without success. A mathematician, of similar qualifications, after surveying the situation for about 30 seconds, solved the problem and moved the machine, single handed. In a like manner, when the alternator was to be tested the honours engineers were quite useless and the job was eventually done by an unqualified maintenance engineer.

All this suggests that some alteration is needed in university curricula and this is pointed out by the fact that, until this year, there was nowhere in this country an undergraduate course in electronic engineering. No doubt these assertions will be unpalatable to the Institutions who seem to hold so dead a hand upon this type of university education.

Turning now to the internal devices of the machines themselves a situation is revealed which is at once encouraging, and at the same time disturbing. In the past major developments in the design of computers have started in Britain. Thus, the cathode ray-tube store was a British invention, as was the magnetic drum. The delay line store was first here and operated in a satisfactory manner and the nickel delay line and its variants were again developed in Britain. Alone of the modern storage devices, the ferrite core matrix was developed in the USA, and this only because, when the desirability of rectangular-loop ferrite cores was suggested to a major European manufacturer, he was assured that such were ' impossible in theory! ' The provision of cheap, high speed, storage is still the great unsolved problem of computer designs. The first technological break-through seems to be the thin film magnetic store and it is pleasing to note that the most advanced techniques in this field are those developed by Bradley and Prutton at the research laboratories of ICT. Here the problems of reproduceability appear to have been solved and the speeds of operation attained seem only limited by the speed of the driving elements. This bright picture suggests that the natural course of action is to capitalise on the development and to sell the storage planes to all other interested parties. This is

' . . . two or three years seem to elapse before we catch up with American practice, by which time the techniques are already obsolete.'

important since US interests will develop the techniques independently and, because of their smaller ' inertia ', capture the market.

ROLE FOR NRDC

Before leaving this aspect of British work it is worth seeing why more has not been done when the country is so rich in ideas. One of the better things to come from post-war governments was the National Research and Development Corporation. This provided a means of exploiting, and protecting, inventions originating privately, in the universities, and elsewhere. There is no doubt that the Corporation has done sterling work but it must also be admitted that, to a surprising extent, it is distrusted by the computer industry. The reasons for this are two-fold; firstly, and quite mistakenly, it was thought that no Socialist inspired corporation could be good, and secondly, because of the corporation's action in backing, almost exclusively, one university group and one manufacturer. Whilst this situation is no longer so universally true, the stigma remains and so the corporation cannot fulfil to the greatest advantage, the role for which it is so well fitted and which is so greatly needed.

As to the future of the British computer industry itself, the American scene presents some parallels which are not without interest as predictors. The most apparent of these is the way in which the number of major computer firms has tended to decrease, either by lack of business, or by absorption. The reasons for this are twofold: firstly, some groups entered the field without a true appreciation either of the task or of the competition, and secondly the larger firms, with the necessary sales and service outlets, saw profit both in removing opposition and in acquiring rights in some technical advances. One thing has become clear, it is that classical electronic industry does not flourish when it enters the computer field because it has not the necessary contacts to sell the business machines which alone offer sufficient volume to make production viable. As a corollary to this it may be remarked that commerce requires not only machines but also service and this, again, the electronic industry has not, hitherto, been able to provide.

All of this suggests that a similar situation will obtain in Britain and certain whispers indicate that changes may not be long to come. If, as a result of this contraction, the industry becomes more progressive nothing but good will result, but if a simply more monopolistic situation obtains without attendant progress, the outlook is grim.

Before leaving this somewhat destructive commentary, it is necessary to make reference to Government policy in the field. Very briefly it must be remarked that British enterprise is hardly likely to be stimulated when the armed forces and the census organisers are allowed to spend large sums on American machines when home products, even if somewhat less advanced, could still do the job. The stupidity of such acts would be apparent to anyone except a politician: not only does British industry suffer because of the positive loss of orders but also, and more important, because commerce reasons that if the Government buys American machines, those made over here must be grossly inferior. The crowning stupidity in this field is the ' policy ' with regard to Atlas machines. Here having sponsored the development, the Government via the Treasury and the UGC refused to allow even so large a complex of university institutions as are grouped at London to acquire such a machine and having heard of university plans to augment the Treasury grant from outside sources, expressly forbids the use of the grant in this way. It is a sad commentary on political expediency when proposals for new universities to educate non-existent good students find support whilst research work at existing institutions is hampered for lack of facilities.

While it is easy to criticise, to propose sensible reforms is more difficult. The changes needed inside industry and in University curricula have already been mentioned; one other proposal, however, seems to merit serious consideration. This is the formation of a computer manufacturers' research association. The scheme of DSIR research associations works well in other industries and, in the computer field could perform two important tasks:

(1) To conduct fundamental research on physical mechanisms and logical design.

(2) To implement universal coding systems of the type which are too large and costly for individual forms are just needed to make possible effective competition with the Americans.

There is not space to develop these themes in this note but there seems little to prevent the support of such a research association by industry if the fundamental urge for formation were suggested by the Government. Likewise there seems every reason for the Government to act to foster an industry which is big with potential both in this country and in the export world.

ELECTRONIC COMPUTER EXHIBITION PREVIEW

Being a packaged, miniaturised, 'data logging' assembly of what will be shown on each stand at the Electronic Computer Exhibition (to be held from 3rd to the 12th of October), giving brief details of each of the equipments demonstrated or exhibited for the first time, and other features likely to be of interest. In effect an at-a-glance summary and guide for the busy executive, who does not want to be lost or swamped in the vast array of products.

Account Tokens Ltd

STAND 53.

One of the companies within the Lamson Industries group, Account Tokens specialise in providing customer token plates for retail credit systems. The centre-piece of their stand will be the Dashew Printa-punch which allows data from token plates to be printed and punched on tabulating cards.

Addo Ltd

STAND 4.

This firm, exhibiting for the first time, is showing a range of Addo-X add-listing machines integrated with card punches, tape punches, card readers and tape readers. Ledger posting from punched cards, data collection from remote add-listers linked to a central machine and card punch, data logging, and by-product card and tape production from ledger posting operating will be demonstrated. (Addo-X machines were formerly marketed by Bulmer's Calculators Ltd.)

Ampex Great Britain Ltd

STAND 41.

This company are showing a variety of tape handling equipment, the FR 4000, the TM 2, and a range of drop-cut free computer tapes. The TM 2, a new machine manufactured in Britain, has a revised reel servo system, modified activators, pinch roller assemblies and longer-life vacuum chambers; the makers say it offers increased pulse packing on magnetic tapes.

Associated Automation Ltd

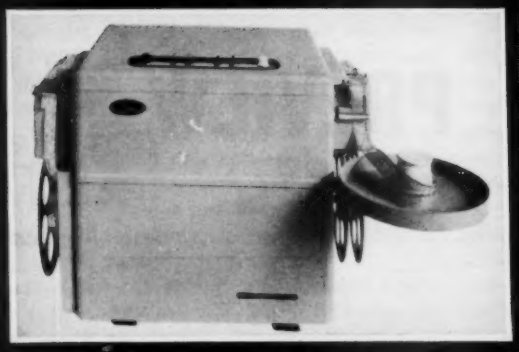
STAND 52.

This company, a member of the Elliott-Automation group, are exhibiting card and tape readers. New card reading equipment includes the automatic strobing card-reader, which can be specified for 65-, 80- and 90-column cards and eliminates the need for special cards; the step-

CHECK ON THESE EXHIBITS

The Creedomat, manufactured by Creed and Co, allows 5-, 6-, or 7-track tape to be produced as a by-product of typing, and allows edge-punched cards and 5- to 8-channel punches to originate typed copy at 100 words per minute; a build up of peripheral equipment permits integration of this complex into an office automation system.

The Dashew Printapunch, marketed by Account Tokens Ltd, uses punched embossed plates and manual keyboard, to print and punch source data on pre-scored tabulating cards or card sets.



By means of the Friden PT 1 converter, shown here for the first time, any 5- to 8-channel code tape can be converted to any other 5- to 8-channel code with controlled tape skipping as required. When converting to 5-channel tape, figure and letter shift codes are added automatically; when converting to 5-channel telegraphic codes the line feed code is inserted.

The on-line magnetic tape units, monitor printer, control console and paper tape reader of the KDP 10 computer, which will be on view for the first time on English Electric's stand.

The KDP 10's high speed tape reader which operates at 1,000 characters per second on seven channel punched paper tape.

ping reader, to be demonstrated in conjunction with Addo-X add-listers; and standard readers with card extension units and card storage trays as output magazines. New tape reading equipment includes a portable tape-punch encoder, and demonstrations will be held of the instant stopping facility—on the character actually read—of the high speed and slow speed tape readers.

Associated Electrical Industries Ltd

STAND 15.

AEI will be showing as their main feature the AEI 1010 computer and certain peripheral equipment—notably the high speed output printer operating at 3,000 lines per minute—from the 32 units (card tape readers and punches, magnetic tape units, etc) which can be simultaneously operated with the 1010 system. The AEI Facit Carousel memory, the high speed tape punch and tape reader will also be shown for the first time, as well as semi-conductor devices, zener diodes, and rectifiers.

Automatic Telephone and Electric Co Ltd

STAND 19.

Using an automatic telephone exchange, terminals on the ATE stand will communicate with terminals on the stands of three other computer manufacturers, transmitting 5-, 7-, and 8-channel unit codes; the demonstration will simulate paper tape transmission over normal telephone circuits. Other low speed data transmission equipment will be on show, for regenerating distorted signals, testing, reading 5-unit business codes and generating pre-set instructions, and also for routing, switching and metering.

Benson-Lehner (GB) Ltd

STAND 32.

This company are showing two electro-plotters, the Model E, and the Model J, the Oscar Model E trace assessment system, and a number of small components such as Model 256-C, 200-A, 16-E, and 10-D shaft codes. The Model J, a new equipment, draws graphs from data which it selects from magnetic tape, at a speed of up to 4,500 short lines per minute; the Model E is an established model with new digital controls and editing facilities. The Oscar Model E allows data from strip chart records to be transferred to punched cards, or tape or to an electric typewriter.

Block and Anderson Ltd

STAND 6.

The Bandatronic and the Typetronic 2215 are being shown. The Bandatronic is a sterling multiplier-printer having electric typewriter input/output with optional by-product tape punching and tape reading input. The Typetronic 2215 is an automatic business document typing system accepting input from edge-punched cards and punched tape, and producing cards and tape as a by-product of typing. It is being exhibited for the first time in Britain.

British Olivetti Ltd

STAND 22.

On show will be three new photo-electric tape converters; the CBN tape-magnetic tape converter with program entry buffer of ferrite cores and field sequence and editing facilities; and the CBS 120 and 400 tape-to-card converters with ferrite core memory, the latter providing full gang punching facilities. Two new accounting machines, the 622 and the 722, allow calculating, printing and data punching—the latter having alphanumerical facilities—will be demonstrated; also the 930 typewriting machine for printing and punching of alphanumerical data.

Computer Engineering Ltd

STAND 51.

On view will be a low-cost solid state computer, said to be the cheapest digital machine on the market. Designed for technical colleges or research departments, it can be attached to analogue-digital converters to provide facilities for machine tool control, production processing.

Creed and Co Ltd

STAND 26.

There will be four new and two modified equipments on show on the Creed stand: centrepiece of the stand will be the £6,000 electro-mechanical system based on Shell-Mex's direct order recording and invoicing system (DORIS) with push button or keyboard entry, a 60 mph punched paper tape memory for storage and retrieval, facilities for selective printing of several documents, carrying our price calculations, and by-product tape or card punching for computer input. Also on show will be the first production model of the 1000 serial output printer (printing out at 1000 characters per minute) and the Creedomat document producing system, a complex of typewriter, tape reader and tape punch. The 3000 tape punch—shown in prototype in 1958—and improved versions of Model 90 verifier and 7P/W keyboard perforator—handling 5- to 7-track tape—will also feature on the stand.

Data Recording Instrument Co Ltd

STAND 37.

On show here will be a complete magnetic tape testing equipment for evaluating tape quality—the first commercially marketed in Britain; a four-channel recorder—developed for the Air Ministry; a new digital tape transport, with a two millisecond start/stop time, improved packing density and special dual write/read gaps; a magnetic drum developed for the GPO; and 4-, 8-, and 16-channel recording replay heads, and others of the firm's range.

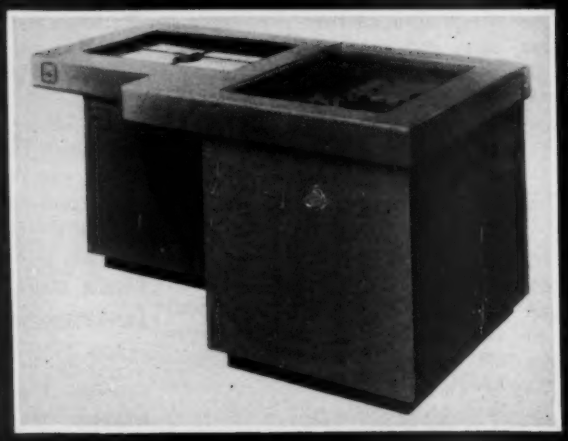
Decca Radar Ltd

STAND 17.

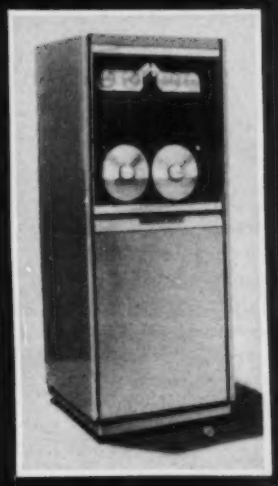
This company are to exhibit the Decca 4000 magnetic tape unit,

Showing on the IBM stand will be the 1620, a scientific computer with punched tape or card input output, and a 60,000 decimal digit core store. Up to 1,780 arithmetic operations per second can be performed.

The Honeywell digital magnetic tape unit, showing the works. It is used for input output or off line conversions, acting as a format converter from typewriter, punched card or tape readers to magnetic tape; or from multiplexers and analogue digital conversions to allow information to be recorded directly in computer code.



The Dobbie McInnes 'D-mac' graph plotting equipment receives input from both paper tape reader and card reader converting the data into graphical form. The Benson-Lehner Model E Electroplotter (see left) also automatically draws graphs from data presented on punched tape.



Decca Radar's Type 4000 magnetic tape unit gives high efficiency tape usage—allowing twice as much data to be recorded on a reel, and reducing interblock gaps to 0.7 inches. Using an interlaced tape arrangement data speeds of up to 180,000 characters per second can be achieved. Dual read-write heads allow instant checking of data; either 1-inch or ½-inch magnetic tapes can be used.

successor to the Type 3000 which was the first tape transport system to go into active production; and supporting ancillaries—16-track and 8-track recording heads, 1-inch and ½-inch spools, air conditioning equipment, etc.

De La Rue Bull Machines Ltd

STAND 22.

One of the exhibition's ' first's '—the first showing of De La Rue Bull's 300 DP series—is the main feature of this stand. The 300 DP complex on show comprises card reader, combined card reader punch, calculator, magnetic drum, and program unit. New features of this equipment are the simultaneous use of two or more reading units, independent dual feed doubling printer output, and simultaneous read/write and autonomous action of tape readers and multi-selectors. The 300 DP will be demonstrated carrying out chain store invoicing and stock and materials scheduling. The IPC ledger posting device, and the posting interpreter, also on show, will demonstrate record card updating and account posting.

Dobbie McInnes (Electronics) Ltd

STAND 34.

Equipment for automatic graph plotting from punched cards or paper tape, allowing computer output to be represented in graphic form, and trace analysis equipment for obtaining card or tape input to a computer, are to be shown by Dobbie McInnes. A selection of analogue plotting tables and pen recorders will also be on display.

Electronic Associates Ltd

STAND 18.

Electronic Associates are specialists in analogue computers (they claim to have installed 80 percent of all analogue installations in the world) and will exhibit a Pace 231R analogue computer with high speed repetitive operation facility—as installed by the Atomic Weapons Research Establishment; the TR-10 desk computer, an *x-y* plotter, the 3100 data-plotter, and several digital voltmeters and computer peripheral units.

Elliott Brothers (London) Ltd

STAND 14.

Elliott Brothers, part of the Elliott Automation set-up, will demonstrate the later version of the Elliott 803 computer in a wide range of real time applications, including air-traffic control, communication network switching, and seat reservation techniques; also handled will be aeronautical engineering scientific statistics, and operational research problems. A scale model of the new Elliott 503 will illustrate its capabilities.

EMI Electronics Ltd

STAND 2.

An EMI 1100 consisting of four units, a 16,000-word drum, five magnetic tape decks, paper tape punch and reader, card punch and reader, teleprinter, and 600-line-per-minute printer, will demonstrate payroll, stock control, sales invoicing, and hire purchase applications. The stand will include a data preparation area, job assembly and maintenance areas, and magnetic tape library. A 22-minute film will be shown of Emidec operations, and a data link will be provided between ATE and EMI stands.

On Stand 36, EMI Sales and Services Ltd., an associate company, will demonstrate Emitape—an instrument tape system.

See us at Stand 48

We hope ADP readers will look in on our stand—on the first floor—at the Electronic Computer Exhibition, where extra copies of this issue will be on sale. Members of the editorial staff will be available by appointment to answer queries and give information.

English Electric Co Ltd

STAND 9.

Three computer systems will be demonstrated, the KDP 10, the KDF 9, and a new system, the KDN 2, designed for process control applications; applications for the Lace analogue computer, and the Deuce system, will be demonstrated. Magnetic tape units, card readers, and automatic pointers, will be shown in action, working as part of an integrated system.

Fanfold Ltd

STAND 42.

A new type of continuous stationery, for use with high speed printers, the ' Fanflex ', will be shown; also the Weber tab on stencils, the Fanfold Joiner for attaching odd lengths of form, and the Fimafold range of form handling equipment.

Friden Ltd

STAND 10.

Exhibiting for the first time under their own flag, Friden will be principally showing their Collectdata equipment, a system for allowing data on punched cards or edge punched cards (also variable data set up on a dial) to be transmitted from a number of remote points to a central processing centre. Also on show will be the punched tape converter, and a range of Flexowriter automatic document writing machines.

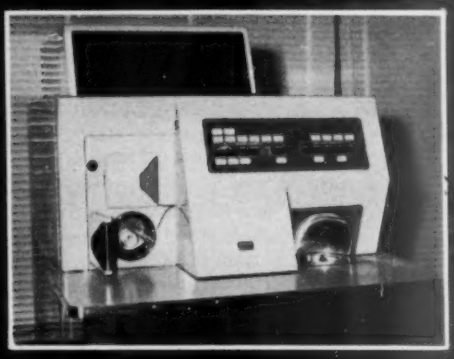
Ferranti Ltd

STAND 8.

The Sirius and Argus computers will be shown in action on stand, the

The production model of the Xeronic printer manufactured by Rank Precision Industries, shown for the first time (though the prototype was shown in 1958). Using a dry printing process, it prints on-line from a computer at 4,700 characters per second, selecting and printing up to four different forms to contain the information; also incorporated is a built-in error-detection device for indicating printing errors.

Solartron's ERA optical scanner, which reads continuous tally rolls at 200 characters per second, converts variations of light and dark to output pulses feeding to tape or card punch, computer memory of magnetic tape unit. The picture shows the reading head and control console.



The ICT 1301 computer which is on show for the first time and for which a number of orders have been taken.

The Lamson Paragon Guillotine for high speed tabulating output handles forms from 12 inches to half an inch wide, cutting and stacking at a rate of up to 5,000 sets per hour.

Punched Card Accessories: Extensi-pull equipment for filing and 'pulling' pre-punched tabulating cards.

latter (designed for process control) operating in conjunction with a working model of a plant. Also demonstrated will be the Data-link transmission system operating between this stand and the Ferranti's stand at the neighbouring Business Efficiency Exhibition. Scale models of the Atlas, Apollo and Orion computing systems will be shown; the control desk of the Manchester University's Atlas computer will also be on view.

General Post Office

STAND 46.

The GPO's communication services for data transmission will be demonstrated: low speed telegraph circuits, telex transmission, and private higher speed speech-type systems; error detection equipment will be demonstrated, and details of the new GPO modulator-demodulator will be available.

Hawker Siddeley Group

STAND 12.

The computer sections of this group, AWE (Armstrong Whitworth Equipment), AWB (Armstrong Whitworth/Bush), and de Havilland Aircraft, are likely to be showing analogue computers, digital data handling systems, digital differential analysers and data requisition devices, which they have designed for companies within the group and for outside organisations.

Honeywell Controls Ltd

STAND 7.

Demonstrations will include the operation of closed process control loops for the oil industry, using a special analogue equipment; and the application of digital computing techniques to multi-channel process control. In this demonstration an MPL magnetic tape unit will be utilised. Details will also be available, of the Honeywell 800 and 400 computers which the company are about to market in this country.

IBM United Kingdom Ltd

STAND 11.

There will be three major pieces of equipment on stand, the IBM 1620 computer, which will be demonstrating scientific and engineering applications; the IBM 1401, demonstrating hire purchase accounting, manufacturing control, invoicing, stock control and payroll, and the 1001 data transmission equipment, with sending out station (consisting of telephone, and terminal containing card reader, keyboard and subset) and central receiving station (telephone, card punch modified by data translator and demodulating subset.) Also on show will be the IBM 1412 magnetic ink reader-sorter.

ICT Ltd

STAND 21.

In addition to the ICT 1301 computer system, which is being shown for the first time, the smaller ICT 1202 computer will be on show, demonstrating a multiple grocery application. Daily branch accounting, sales analyses, and stock control, giving details of branch deliveries, selling price, cost price, gross returns, sales and gross profit percentages, real and theoretical margins, and stock held per branch. The 1301 will demonstrate the use of Cobol and 'Rapidwrite', linear programming on a goods transportation problem, and invoicing.

Jenkins Fidgeon Ltd

STAND 45

A range of equipment for use in conjunction with the IBM 3000—for storage, transport, sorting, and handling of punched cards will be shown. Also on display will be magnetic and paper tape storage equipment, control panels, desks, filing cabinets, and card index cabinets.

Lamson Paragon Ltd

STAND 38.

This company, manufacturers of continuous stationery and associated equipment, will be showing their new guillotine detacher and high speed decollator. Paragon Formaliner equipment and a new electric Linefinder, will be demonstrated in conjunction with a Creed 75 teleprinter, simulating the method in use in Barclays Bank's computer centre.

Leo Computers Ltd

STAND 43.

Peripheral items of the Leo III, the company's parallel processing, solid state computer, are to be shown, notably the high speed Analex printer which prints 750–1,000 lines per minute; the magnetic tape transport, and the paper tape reader (linked to an input assembler) which operates at 1,000 characters per second. Also on view will be the Leo-Kimball tag converter, which will read 150 tapes per minute, and punched 7-channel tape, according to an interchangeable decoding circuit equipment.

MSS Recording Co Ltd

STAND 33.

This company is showing a number of flux-sensitive magnetic tape recording heads used in output printing equipment and automatic controls when the ability to read signals at very low speeds is vital for tape economy. Reply heads with gaps down to 0·00005 inches, and frequency response extending to 0·25 and 1·0 Mc/s, will also be shown, and a demonstration will be given in assessing tape properties, width variations, weaves and skew, very largely independent of tape transport effects.

Mullard Ltd

STAND 47.

The company offer a wide range of transistors, diodes, rectifiers and magnetic core storage techniques. Micro-miniaturisation techniques will be demonstrated, and rectifiers for very high speed logic up to 10 Mc/s prf as well as those for tape and

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card punch solenoids, will be shown, and the latest circuit designs.

National Cash Register Co Ltd

STAND 14.

A new low-cost data processing system, the NCR 390, will be shown; the equipment consists of transistorised processor, console, with paper tape, punched card and encoded ledger card input and output. The high speed card reader of the NCR 315—reading and checking cards at 2,000 (80-column) cards per minute will be demonstrated, and there will also be a representational model of the 315. The latest National Elliott 803, with magnetic core store files (with up to 8,192 word storage) will be shown doing sales analyses, stock and cost allocation processing, and National registers, adding machines, and accounting machines, will be demonstrated, producing by-product tape for computer handling.

Original Document Processing Ltd

STAND 23A.

This company will exhibit the Perf-O-Data system. This allows source documents to be perforated with information, which will then be photo-electrically read and converted to punched tape or cards, at a rate of 150 documents (each of 15 digits) per minute. Also shown will be the Perf-O-Sorter, for check and document handling—4–10 inches in length—sorting at up to 550 documents per minute; and the Carditioner for reconditioning cards.

Panellit Ltd

STAND 14.

Panellit are one of the Elliott-Automation group of companies, and will be showing their 609 system —an industrial information and computing system designed for industrial plant-on-line control, scanning measurements from up to 1,000 different checking points, and providing warning of dangerous conditions arising.

Punched Card Accessories Ltd

STAND 49.

On show here will be ancillary equipment designed to dovetail with IBM 3000 punched card systems, the Stormost magnetic tape storage system, and extensions to the Extensi-pull desk file range.

Plessey Co Ltd

STAND 44.

Plessey, who make a wide variety of control equipment, data link equipment, and special components and assemblies, will be showing the latest developments in random access memories, including a 4,096-word, 2-microsecond unit; square loop cores and assemblies of the Ferramic range, with special handling and testing facilities, and the latest machine tool control and data link equipment. Also on display will be a selection of the latest transistor and semi-conductor equipment, shown in manufacturers' circuits; and the latest developments in conventional components, micro-modules, etc.

Rank Precision Industries Ltd

STAND 24.

The first production model of the Xeronic printer, the fastest output printer in the world, will be the centrepiece of this stand, and will be demonstrated printing out at a rate of 4,700 characters per second.

Short Bros and Harland Ltd

STAND 16.

It is believed that Shorts will be showing the Short educational computer, an analogue machine which automatically displays on the computer board a visual presentation of circuit designs; used primarily for instruction, it can also be used for laboratory use. Also scheduled to be shown, either in real or model form, are a nuclear reactor simulator (simulating the behaviour of an atomic plant) and the Short control system analyser.

Southern Instruments Ltd

STAND 30.

A 12-channel compact motorised trace reader will be demonstrated, covering a sequence of events from transducer to computer output. A multi-channel millivolt recoder, voltmeter, counter, and items of data tape recording equipment, will also be shown.

Solartron Electronic Group Ltd

STAND 1.

Centrepiece of the stand, as far as the businessman is concerned, will be the ERA, the electronic reading automaton, which reads printed tally rolls from cash registers; but there should also be some interesting analogue computers. It is not known whether the SCD 24 analogue computer will be featured; this is a 24 to 168-amplifier machine, based on the twin high gain drift corrected amplifier, the AA 1054. The SCD 10, a 20-amplifier low cost analogue computer intended for technical colleges and laboratories, will also be shown, and the high precision 30-amplifier SC 30, a medium-priced machine for linear and non-linear dynamic problems. The familiar Saki, the automatic keyboard instructor, which has been given a ' facelift ', will also be demonstrated.

Sperry Gyroscope Ltd

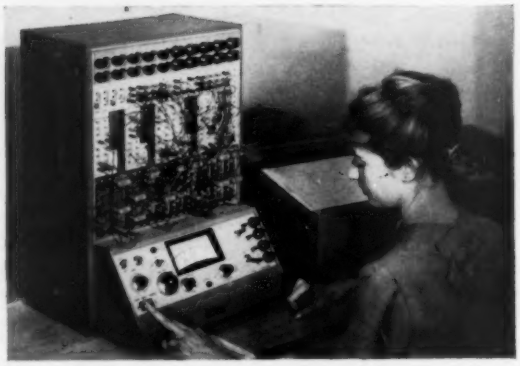
STAND 39.

Sperry will exhibit their magnetic storage drums, Types C, D, and E. Type D has a 3-inch diameter, and should find wide application in air, sea and land transport. Type E is a low speed drum of 16 inches diameter, with ability to be expended up to four times its capacity, by the addition of slave units.

The De La Rue Bull 300 DP series computer complex, a combination of independent units around a master program unit, as the user requires.

The NCR high speed punched card reader, which reads and checks 80-column cards at up to 2,000 cpm.

One of the smaller computers – the portable transistorised analogue EAL Pace TR10 with a Variplotter 1100E on which solutions can be presented in graph form



Standard Telephones and Cables Ltd

STAND 6.

Demonstrations will be held on Standard Telephone's stand, of data transmission over land lines (a leased GPO telephone line will connect the stand to a computer in Harlow). However, the company's prime exhibit will be a basic transistorised Stantec computer system. A display of components (semi-conductors, rectifiers, etc) will also be on view.

James Wilkes Ltd

STAND 28.

This company, who manufacture continuous stationery and peripheral equipment (guillotines, decollators) for computer printers, tabulators, teleprinters, and addressing machines are to show a system for automatic paper handling throughout offices. A high speed decollator, and a form cutter which produces 6,000 forms an hour, will also be featured on the stand.

Random Access VERSUS *Serial Access*

Continued from page 24

simple one. In any particular application the most efficient system must be selected. It should however be noted that most of the memory systems in use today have serial access for the bulk of their information.

Size, required access time, and reliability will be important factors, but cost per bit is likely to continue to be an over-riding

GEOFFREY ZIMAN is senior applications engineer of Ampex Ltd. An Oxford graduate, he worked for several years with Marconi Instruments, then joined Ampex in December 1959 as an application engineer. He is a specialist in computer memory devices.

factor in the selection of storage devices. It is interesting to note that the demand for less expensive random access mass storage has stimulated the development of novel and improved technique in the construction of these memories.

In the next decade it is likely that many new and different random access devices will be introduced onto the market. At the same time the efficiency and transfer rates of conventional serial access devices, such as magnetic tape handlers, will also

be increased to retain their superiority.

The statement has been made, that ' In any type of processing—sequential or random—a properly designed random access system is invariably faster than magnetic tape, in Britain.' This statement requires greater definition before any attempt can be made to prove it. The meaning of the terms ' properly designed ' and ' faster ' could be very different depending on whether they are considered from an overall system, or simple computing viewpoint. Also it is implied that the fastest magnetic tape units are not available in Britain. This is certainly not the case.

In any one data processing system several different memory elements will be needed. These will range from the fast computer program stores to the mass storage of input and output data. For computer programs there is a case for random access storage, since the speed of access is likely to be of great importance. For the storage of input and output data the stronger case can be made for serial access. The most important factors are the low cost of serial storage capacity and the operational flexibility of such devices. Also if it is required to transmit data over any distance then serial forms of operation must be employed. It cannot be denied that the ' father and son ' technique of serial processing does give greater reliability and security of information. (It could also be argued that this is a more natural process!)

In summary, therefore, there is a place in data processing systems for both random and serial access memories. To date, economic factors have tended to favour serial access memories where large amounts of data are to be stored. Serial access gives certain advantages in flexibility in spite of the necessary sorting operations. Also control functions can more readily be organised from a serial access memory.

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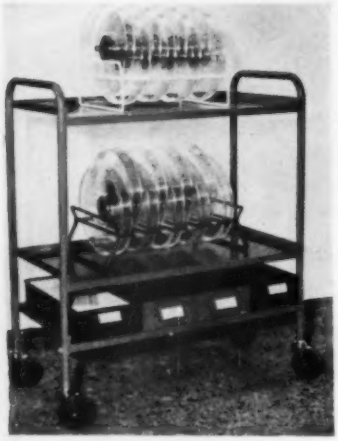

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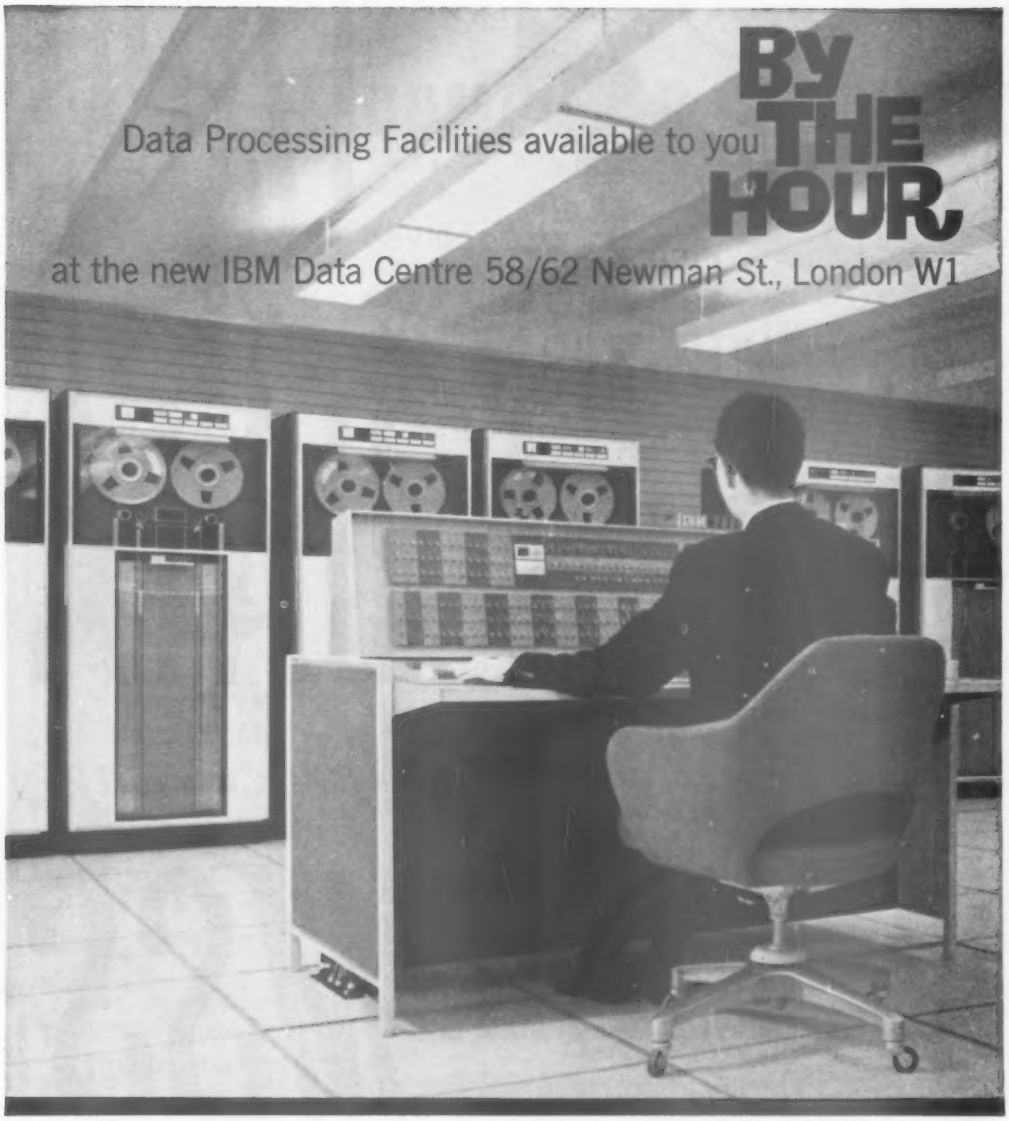

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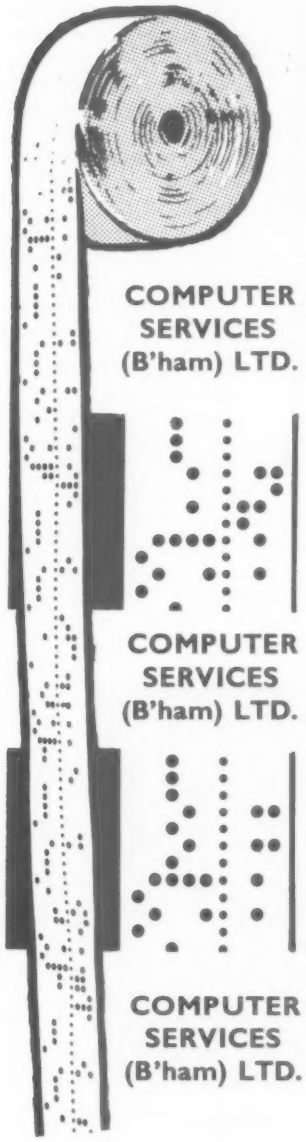

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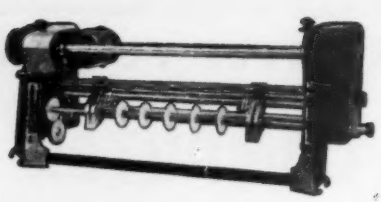

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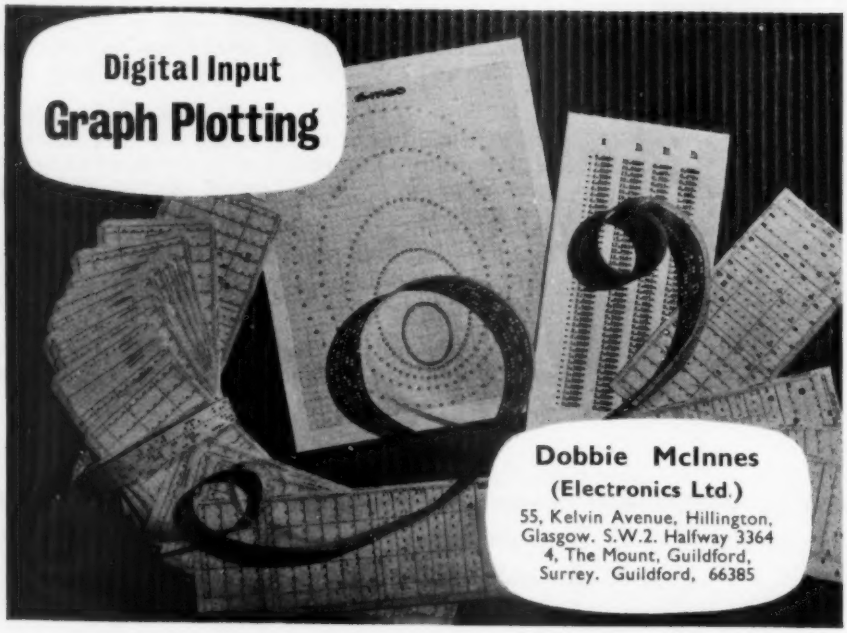

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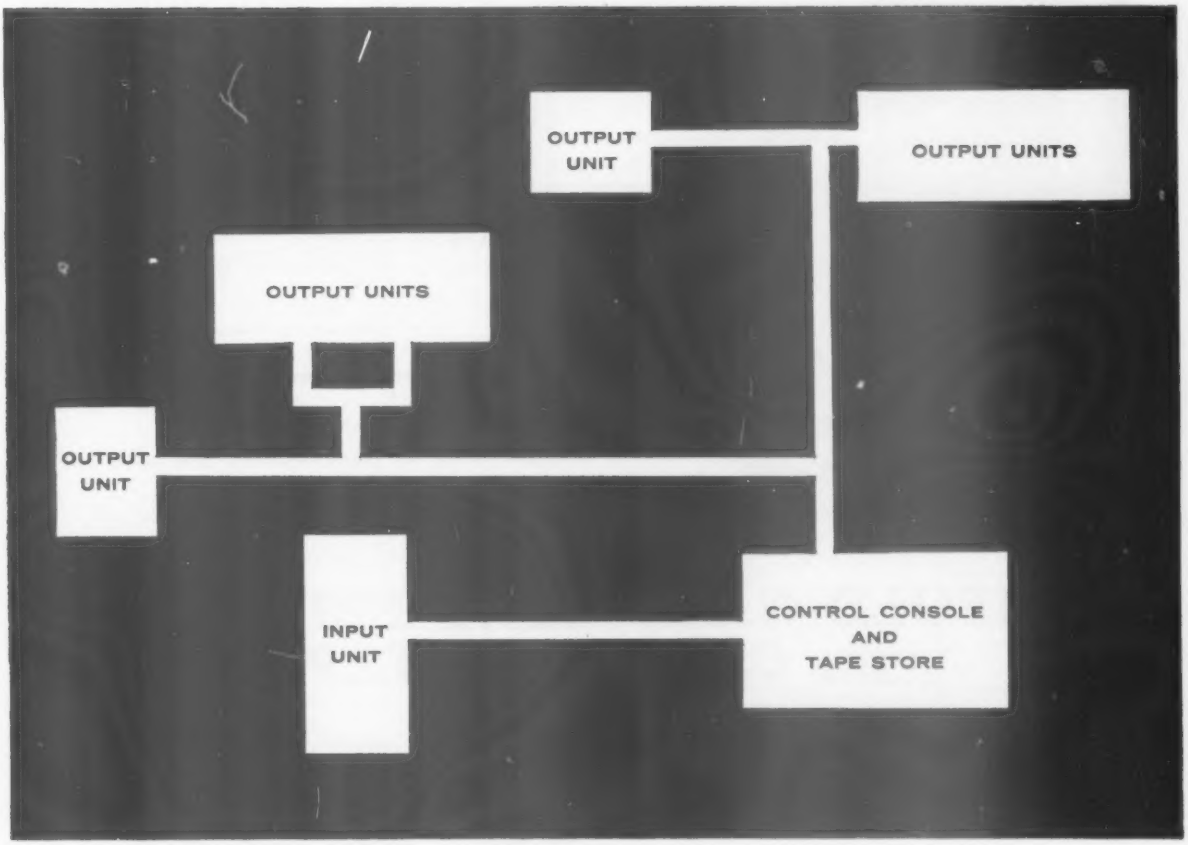

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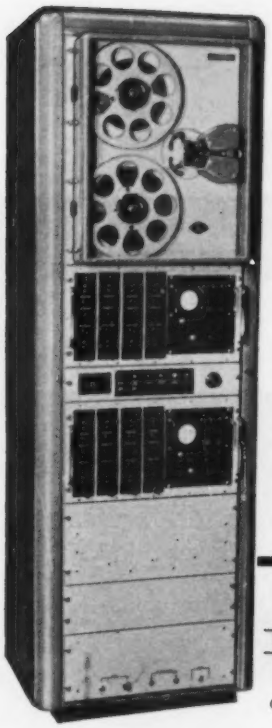

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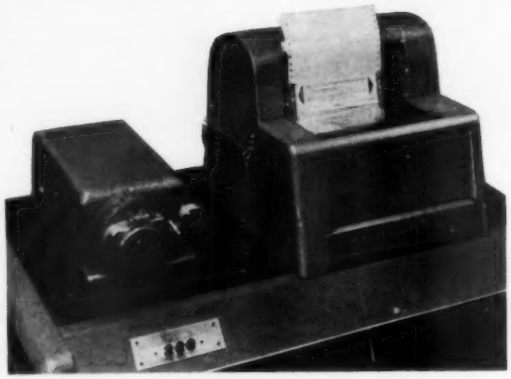

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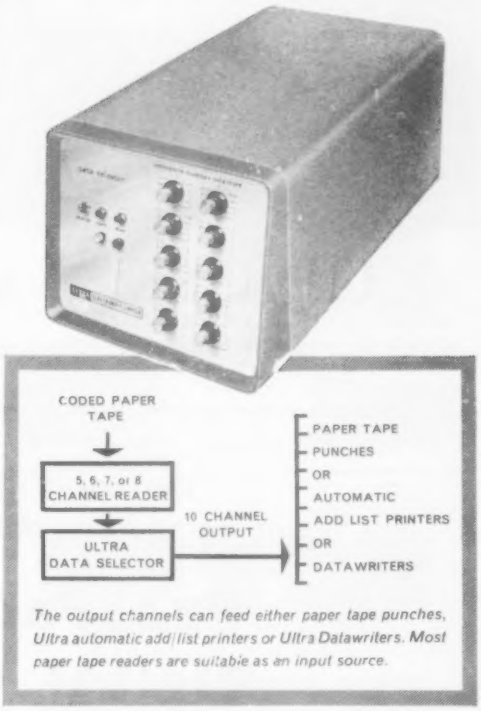

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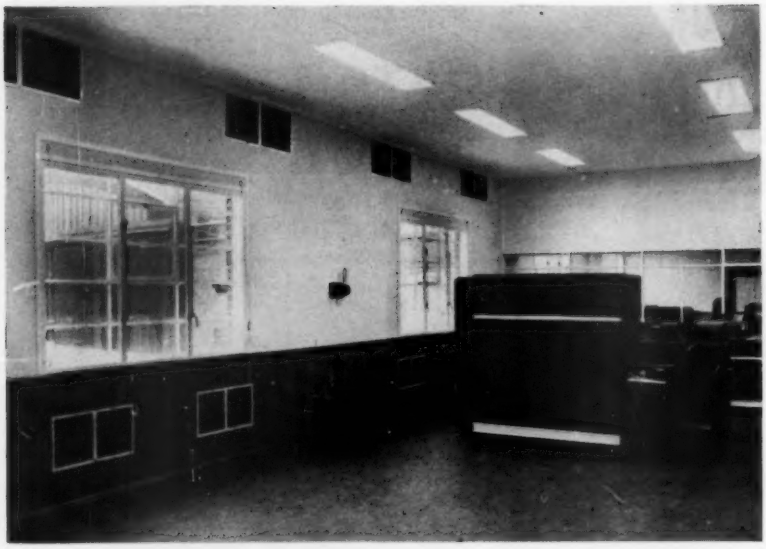

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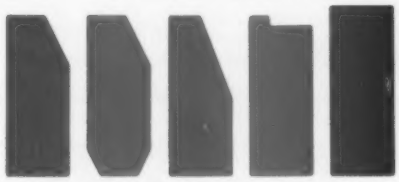

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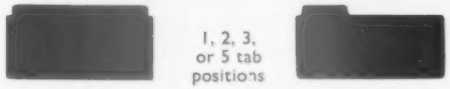

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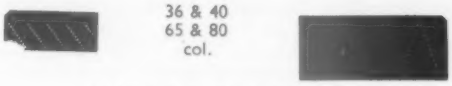

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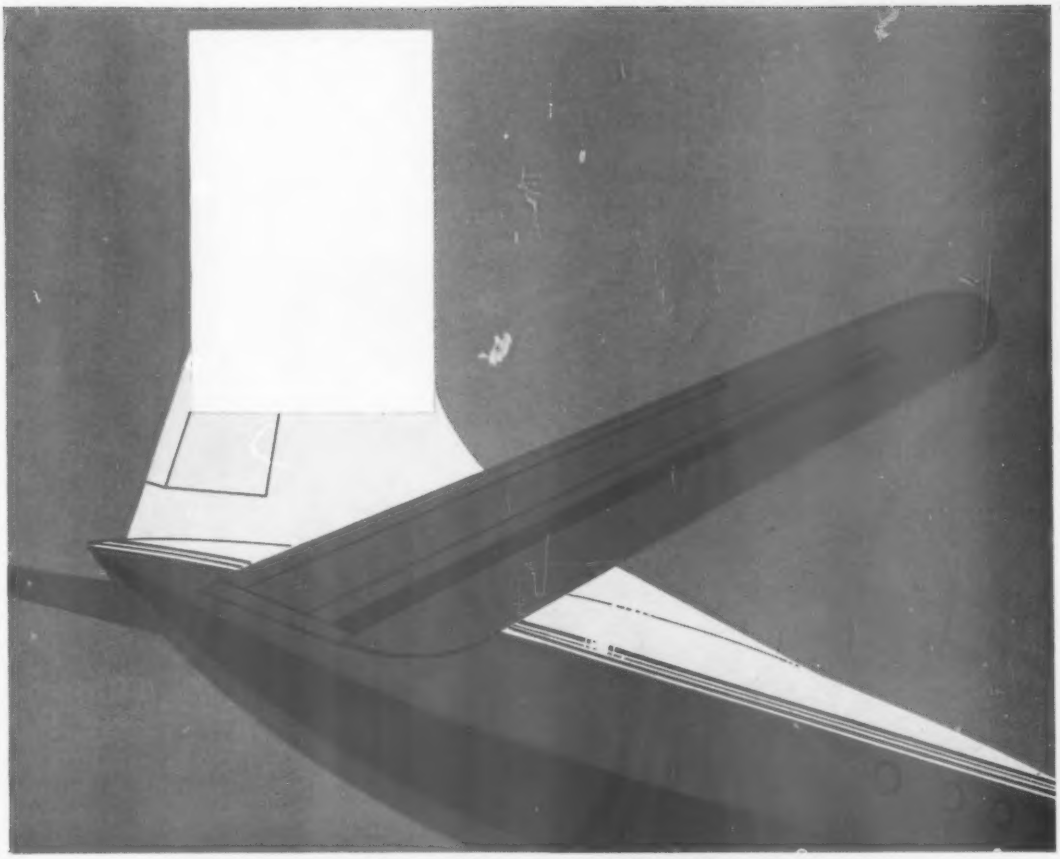
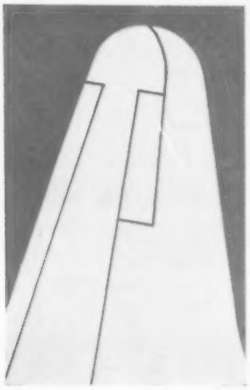


Tuesday's tailplane



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